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ABSTRACT

Results of an undergraduate evaluation questionnaire administered to majors in 12 Engineering and Physical Science departments and programs at the University of California, Berkeley, are presented. Data are offered in tabular and textual formats. Findings are summarized in an introductory section, along with recommendations regarding procedures and topical matters. Within the Evaluative Findings section, the following topics are covered: curriculum: teaching and faculty-student interaction outside the classroom: affirmative action: competition, testing, grading and GPA: student workload: and overall satisfaction. Appendices include information on characteristics of the student population and methods of data collection and analysis. (CS)

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ENGINEERING AND PHYSICAL SCIENCE PROGRAMS AT BERKELEY:

An Academic Review Using Comparative Student Evaluations

January 1980

Chemistry
Chemical Engineering
Materials Science and Engineering
Nuclear Engineering
Civil Engineering
Mechanical Engineering
Electrical Engineering
  and Computer Sciences
Industrial Engineering
  and Operations Research
Computer Science (L & S)
Mathematics
Physics
Geology

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INTRODUCTION: ACKNOWLEDGEMENTS, EPILOGUE, AND A RECOMMENDATION TO THE CAMPUS

ACKNOWLEDGEMENTS

As the Coordinator of the ASUC Academic Review Unit (ARU), it has been my privilege and honor this year to collect, compile and synthesize survey data obtained from students enrolled in 12 upper division academic major programs in engineering and the physical sciences at the University of California, Berkeley.

This program evaluation effort would not have been possible without the support of the 620 students who responded to the ARU's "Undergraduate Major Program Evaluation Questionnaire" and, in most and some cases respectively, to an "Engineering Supplement" and one of four departmental questionnaires as well. If the reader is interested in why the students responded (or to what), the questionnaires and their cover letters are presented in Appendix C.

Special thanks go also to the Engineers Joint Council (EJC), an umbrella student governance group with representatives drawn from all student professional societies and organizations in engineering (including Chemical Engineering). The EJC voted 20-0-1 to sponsor the ARU-coordinated evaluation, thus helping to make it all possible. (No such group was available to work with in the physical sciences area.) In 1979-80 and again in 1980-81, a number of EJC members and other engineering students formed a committee to provide direction and counsel to the project, develop questionnaires, and review the draft report and its recommendations. Paul Kleinen, EJC Secretary (1979-80), was especially helpful, assisting at every possible juncture. The support of the EJC Presidents, William Johnson (1979-80) and Craig Brown (1980-81), has also been important. But beyond these three individuals, at least 20 others could also easily be mentioned for their contributions, but it becomes nearly impossible to draw the line as to where to stop and I hope they will forgive the lack of specific citation for their efforts.

The history of the ARU's previous work, as it contributed to this evaluation, and some additional background information on this year's project is presented in Appendix A (pages A-11-14).

Funding. Funding for this work was provided by the (former) Office of the Associate Vice Chancellor for Academic Development, upon recommendation of the Council on Educational Development (a committee on the Berkeley Division of the Academic Senate), with money provided by the State Legislature and Governor, initially granted at the request of the U.C. Student Lobby (Student Body Presidents' Council), for improvement, innovation, and evaluation of undergraduate education and teaching.

EPILOGUE

More and more evidence suggests that the ARU's type of systematically-comparative, survey-based, student evaluations of educational programs are one of the most reliable, valid, and democratically-representative indicators of the success, needs and problems of academic programs (c.f., Appendix A, pages A-1-4, A-15-23). Moreover, a comparative analysis often provides results with ten times the power of an isolated, one-program review, and leaves far less room for manipulation of the results.

In the 4 1/2 years that I have coordinated the ARU, the students at Berkeley have had a program that is almost undoubtedly unique in the entire nation.[1] Some other institutions do use survey-based student evaluations in their assessments of academic programs, but few do so as comprehensively. And probably none of these other institutions have the evaluation project lodged within student government offices. The special nature of the ARU's work was recognized by U.C.B.'s accrediting team, which last year wrote: "We were particularly impressed by the unusual extent to which the administration has supported thorough student reviews of [undergraduate] academic programs."[2]

Despite sometimes lengthy questionnaires, students too have shown their support by providing 50-60% response rates (overall) in every one of our five large survey projects. Although the role of an evaluator (and advocate for undergraduate students' educational needs) is not one that is readily accepted by those who are responsible for the programs being evaluated, I have greatly appreciated that some faculty and administrators have recognized the value of the ARU's work. Unfortunately, most U.C. administrators and faculty members do not place a high priority on upper (let alone) lower division education. For example, the College of Letters and Science, under the leadership of its former Dean/Provost and its Executive Committee, has not been interested in developing fully effective and comparative processes of undergraduate program evaluation, nor even in establishing schedules with which the ARU could coordinate. In some programs, alas, especially those with low ratings (e.g., Spanish, Psychology), many faculty tend to have even worse attitudes toward students' needs and views. And, one way or another, the University's leadership tends to want to overstructure, manipulate for budgetary reasons, refuse permanent status or personnel for, or even terminate, some of the interdisciplinary and innovative programs which are most highly-rated by the students in them (e.g., the Social Science Field Major, Women's Studies, and now, perhaps, the Conservation of Natural Resources major).

On the salary front, the (former) Office of the Associate Vice Chancellor for Academic Development and the Council on Educational Development (CED) have been particularly niggardly toward those few ASUC and Graduate Assembly (G.A.) projects which require work/job classifications equivalent to the University's "Administrative Analyst" or at least the "Assistant Administrative Analyst" (although project staff may have virtually complete responsibility for the work). The latter title pays 15-38% more, the former 38-66% more, than the highest step in the special salary scale used for administration-funded ASUC and G.A. project staff, such that the ARU Coordinator's maximum step is $600/mo. (@ 0.50 FTE). Thus the Coordinator's salary is so low that no graduate student with access to a teaching assistantship (@ $675/mo. @ 0.50 FTE, or 28% more), or a research assistantship which in any way contributes to his/her progress toward the degree, can accept the ARU Coordinator's position. [For example, the G.A.'s review project has changed coordinators five times in the last five years.] Since dedication and self-sacrifice do have their limits, the Administration/CED de facto undermine the possibility of obtaining good personnel for the ARU.

At minimum, the comprehensive and comparative evaluations that I have undertaken require: 1) a full knowledge of survey research, from logistics and questionnaire development through data processing; 2) an ability to write/synthesize the results of such surveys; 3) a broad knowledge of the campus, including its educational and academic-governance processes and its many fields; and 4) an ability to work with a diversity of students and to appreciate their different motivations and interests (i.e., even if their worldviews differ from that of the Coordinator).

Thus it is not at all assured that the ASUC will be able to continue a program of multi-departmental, systematically-comparative, survey-based assessments of academic programs by undergraduate majors and lower division students. Since the ARU Coordinator is under the jurisdiction of the ASUC Academic Affairs Vice President, there are also the vicissitudes of ASUC politics to cope with (and, unlike the G.A., no merit-based personnel policy), such that ARU personnel are in jeopardy twice a year (once in December during the CED's budget review and again when the new ASUC Vice President takes office in late June). Moreover, it has more than once occurred that the administrators and faculty associated with the CED have pressured the ASUC to eliminate particular staff members--not for reasons of incompetence, workload or quality of work, but for political reasons or because many faculty members do not cooperate with ASUC efforts, however legitimate in nature. Thus the odds of maintaining a successful program of the type described are almost insurmountable. If ARU survey work survives at the ASUC, it is most likely to return to one-department evaluations of a valuable but more limited scope.

A Recommendation to the Campus

If the ASUC can maintain a program such as pursued by the ARU during the last 4 1/2 years, the UCB Administration and faculty should see to it that the information is used more effectively and heeded to a much greater degree, in the campus' program review process, whether in L & S or the professional schools and colleges (including to meet their accreditation review needs). Clearly, also, CED should provide a proper level of remuneration.

If the ASUC cannot maintain such a program, I strongly recommend that the UCB Administration establish mechanisms, including a faculty-student oversight committee (with 30-50% students) and one full-time staff person, to obtain periodic, comparative, survey-based, student evaluations of academic programs at all levels of undergraduate study. (The staff person would also assist in developing and compiling other institutional data useful in the review process and in briefing committees on all data.) A rotational cycle of 5-7 years, in which all campus programs are evaluated, should be developed. The focal areas might include: 1) the humanities (or, the foreign languages could be treated separately); 2) the biological sciences (including some College of Natural Resources programs and possibly Landscape Architecture and Optometry); 3) the social sciences (including Business Administration, Social Welfare and some College of Natural Resources programs); 4) engineering and the physical sciences (possibly including Architecture); 5) lower division education (by college); and 6) other (special studies, etc.).

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[1] See Appendix D for a full list of ARU reports, representing most of the published but none of the follow-up or "resource person" work. One snapshot of the ARU's results (excluding lower division) is given on page 91 and, in a more aggregated fashion, can be found in the comparative data included in many of the tables in this report.

[2] Report to the Western Association of Schools and Colleges on the University of California at Berkeley on behalf of the Evaluation Team which visited the Berkeley Campus on February 26-29, 1980," page 12.

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SUMMARY OF FINDINGS

Introductory Overview

Overall, the evaluation of the 12 Engineering and Physical Science departments and programs which are the subjects of this report received ratings which ranged from adequate to good; none were rated as weak, poor or very poor, and none were viewed as very good or excellent. This statement is made in the context of a total of 47 undergraduate major programs thus far evaluated by the ASUC Academic Review Unit. In terms of overall student satisfaction with the major program, which is the best single example, five of the programs in other disciplinary areas received ratings which were clearly higher, and 13 received ratings which were lower, some only nominally so, than observed in any of the Engineering and Physical Science programs.

PROBLEMS AND SUCCESSES OF THE DEPARTMENTS AND PROGRAMS

Although the main body of the text gives equal emphasis to program successes and problems, the summaries associated with each section of the "Evaluative Findings" (see the abbreviated references to individual programs along the margins of the text) are designed to enable a ready focus on such problems as do exist. The principal value of an evaluation such as this is, after all, to identify areas of needed improvement and to help reduce any gap between the expectations or claims about quality and its actualization at the program level. (Stellar as well as weaker performance ratings may also readily be discerned by a perusal of the data tables throughout the report.)

Because the text has been structured to allow for easy identification of the principal problem areas for each of the programs evaluated, this summary does not generally focus on the individual programs (except when the results are exceptional), but usually looks instead at the Engineering and Physical Science programs as a whole or in groups. Thus the summary generally omits mention of findings derived from four questionnaire supplements specific to (four) departments, but the program abbreviations along the margin of the text, and all text in italic type, will facilitate a more detailed examination of these results.

SUMMARY FOR THE ENGINEERING AND PHYSICAL SCIENCE PROGRAMS AS A WHOLE[1]

CURRICULUM [page 2]

-- Structure of the Major [page 2]. In the engineering programs (including Chemical Engineering), but not in the physical sciences nor in the other disciplinary areas, some of the lower division prerequisites tended to be regarded as unnecessary,*** and the number of courses required for the major as too high.*** In the College of Engineering (where the only inquiry was made),[2] freedom of choice in selecting humanities and social science electives was usually regarded as more effective educationally than the current requirement for three courses taken in the same department, one in upper division.

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[1]See Appendix A, page A-12, regarding the application of the data totals to the "average" student in engineering and the physical sciences.

***The probability that there are statistically significant differences between two or more of the department/program ratings (means) for this item is below .0000.

The probability of significant differences is below .01 (see *).

*The probability of significant differences is below .05 (see ***).

[2]The words "only inqiry" indicate that an item was asked only of engineering students or in a department-specific supplement. Otherwise, the information is from responses to the Undergraduate Major Program Evaluation Questionnaire.

The number of curricular options in which to pursue the major was typically seen as sufficient,** and the courses were regarded as relating well to each other, such that it is easy to get a good perspective on the field.**

Large lecture classes were not usually seen as providing adequate learning opportunities (especially in Geology).** In some programs, especially the larger ones, there were not enough small classes; in others, the problem was not as severe or there was no problem.*** The availability or scheduling of classes listed in the catalog was something of a problem, particularly but not exclusively in the smaller-sized programs, affecting at least 35% of the students overall.**

-- Coverage of Content in the Major [page 8]. As expected within the major program (and similar to results in the one other disciplinary area where inquiry was made), large to overwhelming majorities of the respondents in every program regarded their coursework as interesting and challenging.**

Advanced courses of interest to the majors, whether in their own or another department, were generally but not invariably available.**

Course coverage concerning the contributions of nondominant schools of thought (e.g., environmentalist, low-technology, etc.) was usually seen as weak by the 59% of the respondents who marked one of the five scaled response categories. (Respondents who did not reply to this question may feel they lack sufficient information about the content of many of their program's courses or, if attention to such subject matter/interpretations is insufficient, as the respondents to this item indicate, many students may be too little aware even that their field has such intellectual complexities.)

Opportunities for academic-experiential fieldwork, internships, group study or laboratory courses, or credit for appropriate types of volunteer experiences, were viewed as sufficient in number by about half of the respondents.* Methodology, lab or technical courses were seen as up-to-date (and not as overemphasizing traditional methods), but fairly often not as being sufficient in real problem-solving/analysis.** There was a very severe shortage of equipment, computer facilities, etc. for L&S Computer Science (especially) and EECS students, and something of a problem in a few other departments as well.*** In the engineering departments (only inquiry), the emphasis on theory and application was in good balance.*

In the four engineering departments where inquiry was made, the majors felt a moderate to strong need for a required course in technical writing.

-- Course Evaluations in the Engineering Departments [page 14]. For the needs of engineering students (only inquiry), the lower division classes in the Department of Engineering, and the required coursework in the Math and Physics Departments, were usually regarded as providing effective instruction and content, but the laboratory portions of Chemistry Department courses** and Chemistry 1A-B/4A-B received only adequate ratings in this respect, especially apart from Chemical Engineering students.

In four of the engineering departments (only inquiry), all the required upper division courses were rated as to student satisfaction, and to their applicability or relevance to the student's areas of interest. Chemical Engineering courses received the best ratings on both counts; courses in Materials Science were perhaps least relatively satisfying; courses in Civil Engineering were rated somewhat bimodally on the extent of their applicability or relevance; almost all of the Mechanical Engineering courses were given middle-level ratings on satisfaction and on applicability or relevance, with few high- or low-rated courses.

TEACHING AND FACULTY-STUDENT INTERACTION OUTSIDE THE CLASSROOM [page 18]

-- Elements of Teaching [page 18]. Overall, a fairly large majority of the students indicated that faculty teaching in their program was challenging, of high

quality, and increased their interest in the subject matter,* but such ratings were typical of the one other disciplinary area where this question was asked.

A third of the students (34%) disagreed, and 28% agreed, that their program's faculty show enough concern about social issues in teaching their classes. Compared to observations in other disciplinary areas, these ratings were indicative of less sufficient attention to social issues. In the engineering departments (only inquiry), a two-to-one plurality would like faculty to put more emphasis on the social responsibilities and ethics related to the profession and its practice (including the impact of technology and practice on environment, social structure and individuals).* (A quarter of the respondents chose the middle response.)

Overall, with Geology rated best, the respondents were evenly divided as to whether feedback on their work (all types), by faculty, T.A.s and readers, was thorough enough.** While a plurality disagreed, a quarter of the respondents who had needed further explanation or extra instruction agreed that they did not find help or a referral easy to obtain. The extent of problems with obtaining extra help was greater in engineering (especially) than in other disciplinary areas.

The sample as a whole rated almost two-thirds of their T.A.s as being knowledgeable and well-prepared in the material to be taught** but only a little over half as being effective teachers in discussion sections and labs.** In both cases, lower ratings were found in the engineering departments than in the physical sciences (and in one other disciplinary area where inquiry was made). A large majority of the engineering students (only inquiry) had had one or more T.A.s whose skills in the English language were simply not yet adequate.

-- Faculty-Student Contact [page 23]. The "average" student had about one discussion per month outside of class with a professor, with one-sixth having none at all in the last three school months. The "median" student was known by sight* to six faculty members, by name to three, and to some extent as an individual person by one, with 39% of the students not known to some extent individually to any member of the faculty. The situation as a whole perhaps was worst in EECS.

Almost half of the respondents disagreed (and 40% agreed) that there was at least one professor who knew them or their work well enough to write a good letter of recommendation.** Apart from a very poor situation in L&S Computer Science, most programs were rated from barely adequate to good in the extent to which the students had a regular faculty advisor (or otherwise knew a faculty member in their program) to whom they comfortably could go.***

Overall, student satisfaction with the level of interaction they had had with professors at UCB was so-so at best, with Geology the only highpoint.*

-- Faculty Receptivity to Students [page 28]. In responses typical also of other disciplinary areas, two-to-one pluralities (i.e., less than a majority) of the Engineering and Physical Science Sample denied that faculty members in their program don't seem interested in or concerned about undergraduates, and affirmed that faculty-student communication is open and fairly extensive,** with Geology being rated very positively in the latter regard. Roughly the same response was given to the question of whether faculty were receptive to student input on the structure and content of program coursework.

A very large to overwhelming majority of the respondents indicated that faculty in their program were neither more nor less supportive of and receptive to women as against men students, and to ethnic minority as contrasted with white students, but a few more questions were raised in the latter regard.

AFFIRMATIVE ACTION [page 31]

-- Student Affirmative Action [page 32]. On the matter of student affirmative action, a plurality to overwhelming majority of the students in every program were

of the opinion that the proportion of women students was too low;*** opinions were a little less strong (a 55% majority agreement) that the proportion of Black, Chicano and Native American students was too low.

-- Faculty Affirmative Action [page 32]. On the matter of faculty affirmative action, students in every program believed there were not enough women faculty members. Student opinion about the number of ethnic minority faculty was more mixed;* overall, a plurality saw an insufficiency.

COMPETITION, TESTING, GRADING AND GPA [page 34]

-- Competition and Its Effects [page 34]. About two out of five respondents agreed that they studied and learned best in an environment with competition at a level such as they've found at Berkeley; three out of ten disagreed; one quarter chose the middle response. Competition was regarded more positively in Engineering and the Physical Sciences than in most of the programs in other disciplinary areas, and the respondents in most of the Engineering and Physical Science programs were also usually somewhat more impressed by the caliber or motivation of their fellow students.** However, possibly for reasons of competition and workload, a third of the engineering respondents (only inquiry) tend(ed) to choose humanities and social science electives for reasons of convenience of scheduling or moderate workloads; 47% tend(ed) to choose such electives in order to gain some important general or supporting knowledge/understanding. In their choice of technical electives, on the other hand, very large to overwhelming majorities in all of the engineering programs chose more for the latter reasons, and only 8% tend(ed) to choose more for reasons of scheduling convenience and moderate workloads.

-- Testing [page 36]. What courses would cover, and what students would need to know or do to get an "A" grade, was made clear by faculty at the outset of less than half of the classes. Nevertheless, at least a bare majority in every program agreed that tests in most of their courses were fairly accurate measures of their knowledge of the material taught--although strong agreement never exceeded 11%. As one specific in this regard, from the engineering departments (only inquiry), a plurality felt that time pressures on midterms had unjustly influenced their grades. Faculty efforts to prevent cheating in the engineering programs were rated as only barely adequate (only inquiry), especially in the larger departments.

-- Grading [page 38]. Grading in almost all of their own program's courses was rated as more rigorous than the students found in other courses.*** Although a plurality of the engineering students (only inquiries) thought their homework should be given more weight in the grading, a majority disagreed that "absolute standards," with tests for mastery of fundamentals, were preferable to curve-based grading, with tests for detailed knowledge.

-- GPA [page 40]. By program, the respondents' average GPA for all courses taken at UCB varied significantly, ranging from 2.88 to 3.32.*** Measures of student workload (reports of hours of study per unit per week in Fall 1979 and program workload ratings) did not correlate with GPA at UCB. The strongest predictor (10%) of overall GPA at UCB, of 30 measures examined, was student ratings of the ease of grading in their major program.

STUDENT WORKLOAD [page 42]

-- Assessment of Student Workload [page 44]. The sum of hours of class and lab, and of study per unit per week outside of class and lab, clearly exceeded Academic Senate standards in seven of the 12 programs and most probably did so

also in at least two others. Also, student ratings of the workload in the courses in eight of these nine programs were higher, often much higher, than those found in other disciplinary areas.*** In four engineering departments (only inquiry), the unit values of many of the required upper division courses were rated as one-third or more units too low: Chemical Engineering (50% of the courses), Materials Science (44%), Mechanical Engineering (25%), Civil Engineering (36%).

-- Possible Solutions to the FTEness and Program Workload Problems [page 49]. On the assumption that plans were being made to increase unit values in 5-10 of their lower and upper division courses (e.g., each by one unit), students in engineering (only inquiry) rated the desirability of nine possible ways of making adjustments in their programs. The most favored option overall, and in four of the departments, with a rating equivalent to "use some," was to raise to more than 180 the number of units required for the degree (i.e., give proper unit credit without otherwise changing the program).** Some use, though a little less, was also favored of "leaving things as they are" (ranked second). Other higher-ranking options, with a little to some use recommended, each progressively less favored, were: to reduce the number of units required in the humanities and social sciences;* to reduce the homework in required courses where it is too detailed; to reduce the breadth and/or depth of coverage in courses that are required but of lower priority; and to reduce the extent of lab work in required courses. The least favored methods, with ratings equivalent of "use a little," were: to lower the number of free elective course units; to lower the number of technical electives; and to lower the number of required upper division courses in the major.

STUDENT LEARNING [page 56]

-- Remembering of Material Learned [page 57]. Overall, 54% of the Engineering and Physical Science students agreed (and 19% disagreed) that they would remember what they had learned in their program's courses for a long time to come.** While at least a plurality agreed in every program, all of the engineering programs received ratings indicating that probable retention levels would be lower than those in the physical sciences and in the other disciplinary areas.

-- Basic Skills [page 57]. At least a plurality of the respondents in every program, and a large majority overall, felt both that their skills in written communication would be adequate by the time they graduated,** and, by majority overall, that their skills in oral communication would be adequate too.

With almost no doubt, skills in quantitative analysis were rated as likely to be adequate by the student's time of graduation. In the engineering departments (only inquiry), however, skills in/on computers, by the time of graduation, were rated as fairly likely to be adequate in three programs and less than adequate for many students in four others.***

PROVISION OF INFORMATION TO STUDENTS [page 60]

Although the helpfulness of program office staff was usually rated as good, ratings in the College of Engineering and L&S Computer Science were all lower than in the physical science departments and the other disciplinary areas.***

The orientation provided for students new to the major was seldom more than barely adequate in any of the programs evaluated.

-- Informational Needs of Students [page 62]. Information provided by the program/faculty about courses and professors was somewhat insufficient in the College of Engineering and the L&S Computer Science program--and generally a little weaker than in programs in the College of Chemistry, other physical sciences and other disciplinary areas.** In the engineering departments (only inquiry),

guidance/information to help students in the selection of humanities and social science courses was similarly somewhat weak.**

Information provided by the program/faculty about graduate or professional schools to which students might want to apply was also somewhat insufficient. However, most engineering students (only inquiry) knew enough at the time of their response to decide "when and whether" to go to graduate school.

Information provided by the program/faculty about career opportunities for students with a bachelor's degree was not really sufficient in the engineering and L&S Computer Science programs, but it was very clearly insufficient in the remaining physical sciences programs and in the other disciplinary areas.*** Engineering students (only inquiry) also definitely wanted more contact with UCB alumni and other individuals and agencies/companies working in their field, but seemed to feel that Career Planning and Placement Center services were quite suitable for many of their general career planning/search/placement needs. Apart from most Civil Engineering students, the engineering majors (only inquiry) were not generally aware of the registration requirements (if any) in their field.***

STUDENT PARTICIPATION IN PROGRAM DECISION-MAKING [page 68]

-- Trust of Faculty Decision-Making [page 69]. When the Engineering and Physical Science students were asked whether they trust faculty to take student needs and views into account in their decision-making for the program, agreement was a little more prevalent than disagreement.

-- Student Organizations and Participation in Program Decision-Making [pages 70-73]. With 30% agreeing they had never been notified of a general meeting of their program's undergraduate organization, it is apparent that notification procedures are unnecessarily weak. There was widespread support (73%, with 8% in opposition) for departments to include undergraduates on most committees, provide an office, allow a quarterly mailing, etc., in order to facilitate undergraduate organizing and input. In the engineering departments (only inquiries), students were also highly supportive of publicly-posted committee membership lists, agendas and background materials. The student professional societies averaged 11% active, 22% occasionally attending/participating, and 23% inactive, dues-paying members--a fairly healthy level of involvement. Interest was fairly high in joining the engineering alumni association after graduation.

-- Teaching Evaluation [page 74]. The system(s) used to obtain student evaluations of teaching seems to be working fairly well, with evaluation forms reaching almost all classes. An overwhelming majority of the students agreed that faculty should occasionally use the Primer (now SPECs) questionnaire so that students will have access to published evaluations of faculty teaching.

INFLUENCES ON STUDENTS' OVERALL GROWTH AND LEARNING [page 76]

-- Academic and Intellectual Influences [pages 76-78]. Of seven possible sources of influence on students' overall growth and learning while at UCB, the instructional process as a whole rated highest in the Engineering and Physical Sciences Sample, and highest, or virtually tied for highest, in all 12 programs. Almost half of the respondents (49%) saw the instructional process as "highly influential" and another 36% marked "moderately influential" (points 3-4 on the 1-4 scale). In addition, the students' own intellectual interests or pursuits were highly influential to 28% and moderately influential to 33%.

-- Interpersonal and Personal Influences [page 78]. The respondents' peers (other students, roommates, friends, lovers, et al.) were the second-most important influence, with 41% being highly influenced by peers and 31% moderately. With nearly equal proportions of the respondents choosing the "highly" and "moderately" responses, 62-63% were significantly influenced by their own efforts at

self-discovery or self-development (apart from those normally occurring through interaction with peers) and by other personal commitments and involvements (e.g., family, employment, adversity, leadership roles).

-- Social, Economic, Political and Cultural Influences [pages 78-79]. Campus and community activities and events, from the artistic to the political, were sixth (of seven) in importance, being highly influential to 15% and moderately so to 22%. Of least impact (9% highly, 24% moderately) were developments and issues in the international, national and state arenas or the general social, political, economic and human situation.

On these seven items, there were often differences between Engineering and Physical Sciences and the Social Sciences (the only comparison group).

OVERVIEW OF PROGRAM CONTRIBUTIONS [page 79]

-- The Subject Matter [page 80]. At least a majority in every program, and a large majority overall (65%) rated as "high" or "very high" the contributions of their program to "gaining a thorough understanding of the subject matter." Only a few students (7%) chose either of the two low responses, but almost three in ten (29%) marked "in between." The average rating of "program contribution" was 17.5% lower (on the 1-5 scale) than the average rating of "importance to you."

--Preparation for Advanced Training and for Careers [pages 83-85]. Perhaps the strongest contribution of the programs was in preparing students for graduate or professional school (with 70% high ratings and 9% low), and program contributions to this goal matched the level of its importance to the students. Program contributions to students' preparation for a career were rated at nearly the same level (62% high, 11% low), but contributions were higher in the Colleges of Engineering and Chemistry and L&S Computer Science than in the physical science departments and other disciplinary areas. There was an 18% gap between the average rating of "program contribution" and of "importance" of this goal for students, with no pattern among the program differences.

-- Liberal Arts Educational Goals [pages 81-83]. A fourth area where the programs were rated reasonably well was in providing training in critical thinking and analysis (with 69% high and 7% low ratings). There was a modest gap of 12% between program contributions and the importance students placed on this goal. As for providing a broad, general, humanistic or person-centered education, the program contributions tended to be weak, with low ratings ahead of high ratings by a 3:1 ratio, and 39% choosing the middle response. Here the gap between ratings of program contribution and of importance to students was fairly large--at 27% of the 1-5 scale. Finally, program contributions were also somewhat weak in the area of promoting social responsibility or developing skills useful in the community, with 50% low ratings, again running 3:1 ahead of high ratings, and a 30% gap between the average ratings of program contribution and of the importance to the students.

OVERALL SATISFACTION [page 88]

-- Satisfaction with the Major Program [page 89]. With reference to their overall satisfaction with all aspects of their major program, a large majority of the respondents (69%) were to varying degrees satisfied (points 5-7 of the 1-7 scale) and 18% were dissatisfied (points 1-3), with the rest (12%) having neutral or mixed feelings.

-- Satisfaction with the Total Experience at UCB [page 90]. Satisfaction with their "total experience while at Berkeley" was expressed to varying degrees (points 5-7 on the 1-7 scale) by 75% of the students, dissatisfaction by 14%, and neutral or mixed feelings by 11%.

RECOMMENDATIONS
(and educational policy and planning contexts)

PROCEDURAL RECOMMENDATIONS

Departments and Programs

Faculty members in all of the departments and programs evaluated in this report should review the text and tables to ascertain the following:[1]

1. Where their students' ratings indicate that their program is relatively less effective than other programs.
2. Where their students rate the program relatively well, but where most departments and programs appear to need improvement.

NOTE: Whenever a problem may be said to exist in any of the areas covered by this evaluation, the abbreviation for the department/program appears along the margin of the page (in the text). These references should facilitate the review of the report as suggested in points 1 and 2 above.

3. Where students' ratings indicate a high performance, suggesting that the department/program in this respect can serve as something of a model and probably should not be subjected to substantial alteration.

In reviewing the report, departments should include students in the discussions of the findings and in the development and consideration of proposals for change that result from the review. If student members are included, initial consideration by a standing or special committee might be appropriate. Ideally, the committee would summarize points raised about the program (perhaps adding a few other thoughts or suggestions), for report to an open meeting of the department to which all undergraduate majors have been invited (they won't all come). (The committee's summary also should be circulated widely and posted before the meeting.) The student presence at the meeting is important to obtain further confirmation as to the importance of the points raised--and faculty may have to encourage the students to speak up--and to obtain student views on any solutions tentatively suggested.) The department meeting would then be used to identify topics which are of significant concern, resolve some of the easier questions, and refer other topics to committee(s), whether with directions for action or for further consideration, study, recommendation and referral back to a subsequent meeting of the department.

Campus, Senate and College Authorities

Some of the recommendations following below need consideration, support, monitoring and/or (co-)implementation by administration and Senate agencies and individuals such as the Committee on Courses of Instruction, Committee on Educational Policy, Committee on Budget and Interdepartmental Relations, the Executive Committee of the College of Letters and Science and equivalent committees in Engineering and Chemistry, department and program chairpersons, deans, provosts, the Vice Chancellor for Undergraduate Affairs, The Vice Chancellor and the Chancellor.

TOPICAL RECOMMENDATIONS

The recommendations which follow are confined principally to concerns which are applicable to several, most, or all of the Engineering and Physical Science departments and programs. A number of recommendations focusing on the engineering departments emerge as a result of survey material in greater depth for their programs rather than from special weaknesses found in engineering but not in the physical science programs. Among the most important uses for these recommendations is their consideration as "food for thought" for persons employing the procedure suggested for individual departments and programs (under "Procedural Recommendations," above). Some of the recommendations, of course, apply to the College level, Senate and campus Administration, sometimes jointly with the individual programs.

REQUIRED COURSES (applicability falls to engineering only)

The engineering departments (including Chemical Engineering) should review closely the lower division courses and courses outside the major department [pages 2-4] which are currently required for the major, with a view toward converting one or more of the least crucial courses (if any) to a "recommended" status or, possibly, omitting one or another requirement, even if only from certain curricular tracks or options within which students may pursue the major (or for students who definitely do not plan to attend graduate school). In the College of Engineering, the requirement for three courses, at least one in upper division, to be taken from a single humanities or social studies department, should be re-evaluated [page 3]. Such a pattern of coursework might nevertheless be recommended, or required only in some departments, if the educational rationale is strong enough.

This re-evaluation of required courses in lower division and outside the major department may be especially important in view of the increase in unit values which seem to be appropriate for a number of courses in many of the programs (see the recommendations on "Student Workload," page xxii). Moreover, at least in some of the engineering departments (where the only inquiries were made),[2] there is a need to eliminate any unnecessary requirements because there appears to be a (continuing and) increasing need for additional coursework in some related areas, for example, to improve students' skills "in/on computers" [page 59] and in technical writing [page 12]. While students in four engineering departments (only inquiries) seemed generally to prefer a required course (or course component) in technical writing, perhaps good advising (student awareness of the importance of the ability to write effectively), ready acceptance by the Colleges of additional coursework in English (and allied fields), or special, companion-course arrangements with English (and/or an allied field) could be used to encompass training in writing within the humanities/social studies requirements.

[1] Whether expressed as percentages of the respondents choosing various response categories or as means (as in the data tables), the student ratings are approximations (as suggested by the 95% confidence intervals in the tables, but they do represent the "best estimate" of students' views. See the discussion in Appendix A, pages A-11-A-14.

[2] This parenthetical expression, or "(only inquiry)" as it is rendered subsequently, means that the information was drawn from the Engineering Supplement administered to students in the seven engineering programs (including Chemical Engineering), or from the four departmental supplements, such that there is no comparative information for Chemistry and the L & S programs, or the departments without the individual supplemental questionnaires.

SCHEDULING AND THE AVAILABILITY OF COURSES

In many programs throughout the campus, including in Engineering and the Physical Sciences, conflicts arise between the scheduling of required courses and elective courses of interest to the student, and among elective courses [page 7]. In addition, such courses may be crowded into one or two quarters or, in the case of electives, not be offered in a particular year. To minimize such conflicts, departments should try: to offer electives in quarters (soon) after their prerequisites have been given; to offer required courses at unique, nonconflicting times, or to generate multiple lecture times for large courses (e.g., via videotapes or a second instructor). Electives likely to be of interest to a fair number of students should not be offered only during quarters in which the general expectation is that the typical student's workload will include 15 units of required courses. Elective courses which require prerequisites not likely to be taken by the student until the senior year (or the last quarter of the junior year) should be offered every year (i.e., replacements should be sought and granted when the usual teachers will be unavailable). In addition, whenever possible, students should be provided with more than a year's notice of which courses will not be available in the following year (i.e., footnote #1, page 48, in the General Catalog often provides information too late to be of any help).

EQUIPMENT

The survey identified two large programs (L&S Computer Science and EECS) where adequate equipment or computer facilities were in extremely short supply, as well as several other programs where shortages were something of a problem [page 11]. While the Undergraduate Major Program Evaluation Questionnaire (UMPEQ) served to document the relative severity of the problem, it could not provide a detailed explanation of the impact of shortages in equipment/computer facilities. One guess is that documentation of the real, human/academic impact of such shortages to students in the program should be developed to help Systemwide Administration make the case with the Legislature for the funding of the University's currently-requested augmentations in the area of instructional use of computers. Dean Pister of the College of Engineering, the past Chairperson of the Academic Senate (statewide), because of his recent experiences in the legislative setting, may have helpful suggestions about the exact forms such documentation should take. The documentation may also strengthen Berkeley's requests to Systemwide Administration for other computing-related resources (e.g., the "noninstructional").

COURSE EVALUATIONS IN THE ENGINEERING DEPARTMENTS, INCLUDING SERVICE COURSES

For the needs of many engineering students (but least so among Chemical Engineering majors), the content and instruction were not particularly effective in UCB's Chemistry 1A-B/4A-B, and Chemistry Department labs did not provide a particularly effective learning experience [pages 14-15]. (Ratings of required coursework in Math, Physics and lower division Engineering were more positive.) Since such problems are likely to exist for students in other departments as well, the Chemistry Department should engage in discussions with the College of Engineering (and its students) and the Biology Council (and students in the biological sciences) about how Chemistry courses might be strengthened to meet the needs of students and programs outside of Chemistry. In these discussions, the possibilities should be explored for a series of "service" courses with a lower number of hours of laboratory (and less detailed labwork), such that student majors in other departments could, as and when appropriate to the studies in each field, shift to courses emphasizing theory and general understanding without having to invest as much time and effort in labs designed to provide experience in the nuts and bolts of chemistry. In some instances, it may also be possible to create separate sections of courses which put more emphasis on content relevant to engineers and/or to other groups of majors. (Some of the engineering students with whom the draft of these recommendations was reviewed reported that U.C.D. has Chemistry courses for engineering students.)

The evaluations of the upper division courses required for the major in four of the engineering departments (only inquiries) are summarized in the text [pages 16-17] and presented in their original detail in Appendix B. To the extent that the students' mean ratings of overall satisfaction with these courses fall below about 3.70 (the equivalent of a "B-" grade), the departments should pay greater (and greater) attention to course restructuring, revitalization, and the vitality of the teaching. Where courses outside the major department have been evaluated at the level of "B-" or lower, their viability as a requirement should be reviewed and/or discussions about possible improvements should be pursued with the department offering the course.

Using the standard suggested in the preceding paragraph, all departments should pay close attention to students' ratings of their overall satisfaction with, or the overall value of, courses offered, and then review and revitalize courses as necessary. (See also paragraph 4 under "Student Workload," page xxii.)

CLASS SIZE

Program curricula (required courses) should be designed and faculty teaching resources distributed so that there are two, or preferably more, low-enrollment classes for every student in the major, preferably commencing in the junior year. This recommendation is fairly important because in no program did even a plurality of the students agree that large lecture classes "can generally provide adequate learning opportunities in this field," and several of the largest departments were thought not to have enough small classes [pages 5-6]. The availability of occasional small classes may also make a substantial difference in terms of students' opportunity to get to know one or more faculty members and to learn the material more effectively. (For some of the problems in this regard, see the subsequent recommendation on "Teaching, Advising and Faculty-Student Contact.")

The latest, nine-U.C. campus assessment of faculty time use appears to indicate that the number of faculty classroom contact hours with students (as well as total hours spent in teaching-related activity) has declined,[1] and based on the results of two previous methods used in the accounting of faculty time use (dating back to 1960), the apparent declines recently have come on top both of previous declines in direct contact and total hours of

[1] In view of the apparent declines in the number of faculty classroom contact hours with students (and in total hours spent in teaching-related activity), as reported in the latest University of California Faculty Time-Use Study: Report for the 1979-80 Academic Year, President Saxon has asked each Chancellor "to work with the Deans department chairpersons, and faculty on your campuses to increase scheduled class hours and restore the pattern of faculty instructional activities to at least the average time levels in the 1977-78 Faculty Time Use Survey" [Saxon letter to Chancellors, October 1, 1980]. As part of this effort, the letter indicated that "I believe it is imperative that each academic department or equivalent unit develop and implement a faculty teaching workload policy," to be "in effect by the end of the 1980-81 academic year."

teaching-related activity and shifts away from attention to undergraduates. In reviewing faculty workload expectations and practices, pursuant to the development of a departmental workload policy, as required by U.C. President Saxon [footnote, previous page], the departments will be asked to give close attention to whether the amount of time is sufficient that faculty currently spend in teaching courses. Certainly any net increase in teaching time made available as a result of this workload review would be welcome in courses at the undergraduate level, especially in the departments impacted by heavy enrollments and few small classes.

In programs with extremely high enrollments, where the insufficiency in number of small classes was greatest, the UCB or College Administrations may need to provide additional teaching staff, at least on a temporary basis, if necessary to enable the program to offer at least two sets of small classes.

Where enrollment levels are more modest and the total number of courses taught is determined to be appropriate (as judged by the workload policies to be developed), but there is a shortage of small classes for undergraduates, program faculty should review the pattern of course offerings (graduate and undergraduate) and change the pattern of class sizes or shift resources between levels of student taught, in order to provide at least a couple of low-enrollment classes for their undergraduate majors. Another possibility, of course, is to encourage undergraduate enrollments in graduate-level classes (see, for example, the interest in graduate classes expressed by Chemical Engineering majors, page 9). This approach would help, with no dishonesty in accounting practices vis-a-vis the State, to overcome Berkeley's FTEness problems [pages 42-43] and strengthen undergraduate education and student contact with faculty, often with little or no cost to graduate education.

TEACHING, ADVISING AND FACULTY-STUDENT CONTACT

In general, the students' responses to most questions about faculty-student contact and faculty receptivity to undergraduate students were not particularly positive (or necessarily more negative than one would expect at UCB), and they were usually typical of results in other disciplinary areas [pages 23-31 and page xi]. Ratings of at least two of the elements of teaching, however, were perhaps somewhat weaker than typical at UCB [pages 18-23 and pages x-xi].

The development of effective patterns of interaction apart from the classroom usually requires faculty effort as well as student initiative. But for many students, faculty must provide very strong encouragement to make contact, and not just make known their availability during office hours and/or at other times for help with the subject matter. Hence, faculty should consider ideas such as: 1) announcing more available times to provide direct assistance to students with questions about the subject matter; 2) pinch-hitting or dropping-in during help-session hours, labs, or discussion sections for which a Teaching Assistant is otherwise responsible; 3) announcing an occasional bag lunch, to be eaten in a commons room at the local student center (e.g.), where all students would be welcome to come and chat over lunch (e.g., from 11:30A.M. to 1:00P.M. or 12:00 to 1:30P.M.); and 4) participating more extensively in the activities of the department's student organization or professional society [page 72].

While no one system of advising can easily be recommended for use by every program, every program should make effective provision for student access to faculty advisors or faculty advising [page 26]. It might be useful too for each department to provide an orientation session for faculty advisors, with the chairperson, experienced faculty advisors, students organization leaders and office staff all providing assistance, especially to faculty who are new (or returning after a break) to undergraduate advising roles. Close consultation with the student organization should help in the development of more effective advising systems (and in better identification of students' informational needs--see "Provision of Information Needed by Students," page xix). Departments should also explore the possibilities for involving representatives of their student organization(s) in their orientation programs for students new to the major (junior level), particularly since none of these orientations were particularly successful to date [page 62]. Possibilities for the use of (stipended) peer advisors could also be explored with the undergraduate organizations. More credit in the faculty promotion process should be given to service in the role(s) of undergraduate advisor, whether formally or informally (see footnote 2, next page). Moreover, since time spent in student advising (and other informal but direct contact with students) counts in the contact hours portion of the assessment of faculty time use, and since the "University Planning Statement 1980" ("Draft for Comment Only") proposes a commitment [page 48 of that report] to strengthen undergraduate advising where it is weak, the recommendations here, and others developed with student major organizations, could prove to be timely.

The first two of the four-point recommendation in the second paragraph above may be especially important to the delivery of a high quality program, since about 25% of the respondents (more than in other disciplinary areas) agreed that they had "needed further explanation or extra instruction in courses in my major, but help or a referral did not seem easy to obtain." With results in many programs again toward the lower end of the campus spectrum (primarily in engineering departments), the respondents were also split nearly in thirds (agree/in between/disagree) about whether feedback on their work (all types) was "usually thorough enough" [page 19].

With the rise in the number of undergraduate students at UCB in recent years, including in many engineering programs and in computer science, there is a likelihood that the adequacy of faculty (and program) attention to undergraduate education may not have kept pace, exacerbating any existing inequities. Perhaps some of the relatively less high student ratings of office staff in some of the engineering and computer science programs [page 61] reflect the impact of increased enrollments (and/or reduced support budgets, and/or departmental practices which have under-emphasized undergraduate education in an institution where research, professional activity and graduate education all tend to have higher priority).

In the general world of teaching, for example, a recent Systemwide Task Force on Teaching Evaluation reported that teaching counted only as 20-27% of the weight in a typical faculty promotion case, whereas research counted as 48-57% (and professional competence and activity as another 13-14%).[1] (The survey of faculty by the Task Force showed that respondents felt that a more ideal distribution of promotional credits was 31% for teaching, 43% for research and creative work, 16% for professional competence and activity, and 11% for University and public service.) However, a good argument can be made that where "professional activity" is expected of faculty, typically in applied fields (such as engineering), such professional activity should be seen as counting toward the credit

[1] University of California, Report of the Task Force on Teaching Evaluation, February 1980, pages 82, 85.

for research.[1] President Saxon has committed $500,000 (over two years), partly through the Chancellors and partly for use in response to suggestions by the statewide Senate's Committee on Educational Policy, and has planned to emphasize teaching further in a revision of the instructions to faculty promotion committees,[2] as a result of the findings of the Task Force.

TEACHING ASSISTANTS [pages 21-22]

All departments/programs with one or more Teaching Assistants (T.A.s) should provide T.A.-training, with unit credit provided for the graduate students. Whenever possible, this training should in part precede the graduate student's first service as a T.A. and graduate students should be in their second year before serving. In programs which must nevertheless rely to some (or even a great) extent on first-quarter graduate student T.A.s whose native language is not English, provision should be made to carefully screen prospective T.A.s for their ability in spoken English, since it is neither fair nor appropriate to impose upon undergraduate students T.A.s whose skills in the English language are simply not yet adequate [page 22]. When necessary because there is no other recourse, prospective T.A.s whose native language is not English should be interviewed by telephone. Where any doubt exists as to the proficiency in English of a particular T.A., a professor responsible for the course should attend the initial discussion section(s), lab(s) or help-center session(s).

All T.A.s, like faculty members, should be evaluated quarterly, using a form for student evaluation of teaching. This form should include certain items and the teaching evaluation ratings of T.A.s should be expected to reach minimum levels of rated effectiveness. Comparison between similar departments of the average ratings given (on "overall teaching effectiveness") by undergraduate students to their T.A.s should be used to provide a substantial part of the assessment of the effectiveness of each department's T.A.-training program, and T.A.-training programs thus judged to be weak should be subjected to faculty and student efforts to improve them.

Teaching Assistants receiving relatively low(er) student evaluations at the end of the first quarter of their teaching should be required to continue (or repeat) in the department's T.A.-training program. Except when vitally necessary (e.g., because of a dearth of graduate students relative to the number of T.A.ships or the absence of enough graduate students with adequate skills in English), no T.A. should be reappointed (or employed as an Associate) unless he/she has good ratings on the student evaluation forms, or at least continues to train and improve his/her teaching. The results of the evaluation by the Engineering and Physical Science students suggests that considerable emphasis in the T.A.-training program should be placed on the effectiveness of the T.A.s as teachers.

PROVISION OF INFORMATION NEEDED BY STUDENTS [pages 60-68]

Student ratings suggested performances seldom more than adequate by their faculties and programs in providing sufficient information about courses and professors, graduate and professional schools, and career opportunities for students with a bachelor's degree. The sufficiency of information in this last area was especially weak outside engineering, chemistry and L&S Computer Science.

The development of effective information for students is in part a continuing need and process. Program faculty and staff should work in committees with representatives of their student organization to identify and provide needed information, in published form and through the advising system (see the recommendations regarding "Teaching, Advising, and Faculty-Student Contact").

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[1] This argument is based on the idea that it is not fair to expect extra work (research and professional activity) from professional school/college faculty when it is not required in the least-applied disciplines in L & S. If professional activity is treated separately from research, rather than as a substitute (though some research might also be expected, e.g., rather than professional activity alone), then the ratio of research to teaching in non-applied fields (assuming more research is expected in lieu of professional activity), using the faculty "ideals" cited in the text, would be 59:31, or nearly 2:1 (the former figure is composed of 43% + 16%). Clearly, this is too little emphasis on teaching, which, in current promotion policies, is implicitly set equal to research. (The practice in faculty evaluation, as noted in the text, is worse yet.) Hence, unless faculty in applied fields are allowed to count professional activity as contributing to the research portion of their promotion cases, they will have much less time to invest in teaching, even though they are required to carry the same class load.

[2] End-of-course evaluations by students of faculty teaching should be collected for every course and the results (means) on ratings of "overall teaching effectiveness" should be summed by course, separately by level of course. Such results will provide a stable and accurate assessment of a faculty member's performance in teaching (e.g., over a two-year period between merit increases/promotion). Separate, retrospective, survey evaluations by students are by far the best supplement to end-of-course ratings. Student majors and graduates should be given a list of all faculty members in their program and asked to rate the teaching by faculty members from whom they have taken classes (e.g., in the last year or two). The procedure would be much as was used here to evaluate courses in four departments [see Appendix B] and should employ the item and scale cited in footnote 3 here. (Such supplementary surveys may be especially useful at the graduate level when class sizes are small and end-of-course evaluations possibly distorted by a lack of anonymity.) In addition, some credit for teaching should be given to faculty members who put in an above-average number of hours of work in any combination of teaching-related endeavors such as direct student contact and advising (formal/informal), supervising independent study, development of new courses, work on innovations in teaching, etc. Serving as a liaison with a student organization might also count, but it could, and service on a curriculum committee probably should, be seen as University service (i.e., count toward meeting expectations for departmental service).

[3] The form for the evaluation of T.A.s by their students should include at least one key item. The item, which is the exact parallel to that recommended for cross-campus use in faculty evaluations (and is also recommended by the Teaching Evaluation Task Force cited in footnote "1," page xix), should read: "Considering both the limitations and possibilities of the subject matter and course, how would you rate the overall teaching effectiveness of this Teaching Assistant (Associate)?" The scale employed should be: "1= Not at all effective: 2: 3: 4= Moderately effective: 5: 6: 7= Extremely effective."

Rehiring of T.A.s should normally be restricted to those who receive a mean "overall teaching effectiveness" rating equal to about 5.6 on the 7-point scale cited above. (5.6 is the equivalent of a "B" grade, the minimum passing grade in graduate school.) Only data from the second and third quarters of the student evaluations of the T.A.s should be considered in reappointment decisions (or the selection of Associates).

In the area of careers, committees should work in coordination with the Career Planning and Placement Center (and other relevant service agencies) to identify and publicize in program-originated and program-distributed materials what kinds of information and services are available through such agencies, and to collect such additional information as may be necessary, for circulation to students and advisors.

A simple handout with a listing of graduate and professional departments, with reference to strengths in various subfields (when known), in general order of the quality of the graduate teaching (and overall reputation), and including reference to further informational and human resources, might serve as a useful starting point to provide students with more information about specific graduate schools. (Such efforts may need to be undertaken at the program level, at least in part.) More detailed information could be compiled for use in advising, or advisors could maintain a list of faculty members to whom the student could go for the most recent information on various graduate departments.

Where they do not already do so, individual faculty and departments should make available publicly the results of their student evaluations of teaching, on occasion by use of the Primer (now renamed SPECs) questionnaire [page 74], and the student organizations should seek to write the departmental descriptions in that publication.

Much of the information noted above might be especially useful if it was initially made available (or, in some cases, cited) during an orientation program for students new to the major. If an effective orientation program is to be developed, program faculty should consult with their student organization to help determine student needs (and to get the organization's leaders to participate in the orientation).

Student ratings of the general helpfulness of program office staff were weaker in the engineering departments and L&S Computer Science (and possibly also in Chemistry) than in other disciplinary areas. While these ratings were still usually fairly good, student and staff views should be explored in greater depth to ascertain the nature of the problems. The assignment of duties to staff by the departments, or faculty attitudes toward the priority of undergraduate education, may contribute to such problems as appear to exist.

SOCIAL ISSUES; PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITIES; SKILLS USEFUL IN THE COMMUNITY; NONDOMINANT SCHOOLS OF THOUGHT

Technology has helped to solve many of the problems of human kind, but it has created some additional problems in the process. Although solutions for many of the technological aspects of social issues, questions and responsibilities have been proposed, their adequacy is often still in doubt. In other areas, the search for solutions has only begun. But often enough, too often perhaps, these social concerns are not given sufficient attention by experts (e.g., university faculty) within the discipline or profession most concerned. But many people can readily think of a host of social concerns needing (closer) attention and more effort by specialists in the relevant fields (as well as by some generalists), preferably not all within the same ideological camp.[1] The students in the Engineering and Physical Science Sample want more opportunities to examine these questions in courses taught in their programs.[2]

[1] For example, a few possible concerns: radioactive wastes and containment/elimination of all nations' nuclear armaments; chemical wastes, carcinogenic agents, pesticide effects on the environment; air pollution (automobiles, coal-based energy plants, various industries); structural safety (dams, nuclear power plants, etc. vs. earthquakes); aesthetic and community values (freeways, buildings); management of human wastes (sewage, garbage, industrial effluents); energy development and conservation (environmental effects of synthetic fuel/oil development, insulation, co-generation); energy alternatives (solar, wind, oceanic, geothermal); capacity of computers to be used for invasion of privacy and social manipulation and control by government, corporations, or by others possessing economic or political power (t.v. has some of the same properties); and so on.

Examples less directly technological, perhaps underpinning much of the questioning, include: the short- and long-term economic, social and human costs of any technological development; the need for improvements and increases in public knowledge about technology; the extent of the public's role in decisions about where and how much to use technology in various areas of life. For that matter, in the sciences generally, the availability of funding for research (which is based on social/governmental priorities and economic power generally) is a factor of primary importance in the shaping of current faculty research, and in the shaping of whole academic departments by means of funding-driven decisions about the expertise (subfield coverages) which should be available on a faculty (and in what number of each).

[2] For each of the questionnaire items focused on areas suggested by the subtitle to this recommendation, the respondents' ratings were indicative of weak to adequate performance (at best) by most of the programs. In their teaching, for example, faculty concern for social issues was rated as being from weak to adequate in all 12 programs [p. 20]. In addition, a 2-to-1 plurality (47% agree vs. 25% disagree, with 27% "In Between") of the engineering students (only inquiry), " would like faculty to put more emphasis on the social responsibilities and ethics related to the profession and its practice (e.g., including the impact of technology and practice on environment, social structure, individuals)" [p. 20].

Among six possible goals of a college/university education, the goal of "promoting social responsibility or developing skills useful in the community" was fourth-ranked by the respondents and was nearly of "high" importance (mean rating of 3.76 on a 1-5 scale). (This goal was of less importance than obtaining a thorough understanding of the subject matter, career preparation, and skills in critical analysis, which had mean ratings of 4.47-4.33, with 5= "very high.") But the importance assigned to social responsibility/community skills was equal to that of preparing for graduate or professional school, or obtaining a broad, general education (means of 3.69-3.72). Overall, 65% of the students rated the importance of the "social responsibility/community skills" goal as "high" or "very high," and 10% as "low" or "very low"; in contrast, 17% rated their program's contribution as "high" or "very high," and 50% rated it as "low" or "very low." The difference between the students' ratings of the importance of the goal of social responsibility/community skills and their ratings of their program's contribution to that goal was the largest of any of the six differentials ("ideal" [minus] "real") [pp. 79-88].

Of the 59% who felt they had the experience to answer (or understood the applicability of the item), five out of ten disagreed that there are enough courses available in their program which explore the contributions of the nondominant "schools of thought" (e.g., environmentalist, low-technology, etc.); only two out of ten students agreed that the current coverage was sufficient [p. 9].

In teaching their courses, most engineering and physical science faculty members should pay more attention to the ethical questions and possible social responsibilities associated with the application of the knowledge which they seek to impart. Criticisms of various existing uses of disciplinary knowledge and technology should be considered more often in the classroom. Examples in lectures, problem sets and laboratories should focus more often on real problem-solving and analysis [page 10], including in areas where there are low-technology alternatives or skills possibly of use in the community at large that can be developed or strengthened.

Given the current underemphasis, priorities for future faculty hiring should be modified to strengthen the general pattern of faculty expertise and coverage in nondominant schools of thought (e.g., environmentalist, low-technology) and in the social responsibilities and ethics associated with the application of the various subject matters. At least one general course in each program should be available for students wishing to undertake an examination of the social responsibilities and ethics, and alternative philosophies of technological use, which are associated with their field (and closely related areas).

Because the findings in support of these recommendations are drawn together at this point from three sections of the text, the students' views about these matters are summarized in footnote 2.

AFFIRMATIVE ACTION

In addition to the need for faculty with expertise in alternative schools of thought and in the social issues, responsibilities and ethics associated with the various programs (above), there remains also a need to identify and hire additional women and ethnic minority faculty members. These needs will continue to be important, or become even more important, as more women and ethnic minority students enter the engineering and physical science disciplines and professions. The respondents felt the shortage of women faculty to be especially severe--the number of women faculty was in all 12 cases judged to be too low [page 32], while the shortage of ethnic minority faculty was not seen as being so severe.

Within the student population, affirmative action needs also continue to be important. Since the proportion of women in the student population in the 12 programs is now approaching 20%, students in all of the programs were of the opinion that there were too few women students. Similar, though less strong opinions were given with respect to the number of Black, Chicano and Native American students enrolled in the programs in the sample.

On the faculty side, the progress of affirmative action is defined by comparing the proportion of women or ethnic minority faculty members in a department with the proportion of women or ethnic minority group members who hold doctoral degrees in that field (the "availability pool"), with the expectation generally that departmental proportions of women and ethnic minority faculty (or "utilization") will match those found in the availability pool. Individual departments are, of course, usually too small to enable one to conclude (with any statistical assurance) that there is a shortage or "underutilization" of women or ethnic minority faculty. One can, however, aggregate across departments by examining the campus' annual reports on affirmative action, which are compiled for the departmental level (if only because hiring of faculty, and the experience of students, is focused in the departments). [Source here is: UCB's Annual Academic Personnel Report, 1978-79 (Vol. 1), pp. VI-5a to VI-5d.]

The availability pools for women faculty in Engineering and the Physical Sciences are extremely low. In Fall 1978 (the latest year for which data have been released), there were 6.25 full-time-equivalent (FTE) women faculty with professorial titles ("ladder" faculty) in the 11 departments included in the evaluation, and 14.51 women faculty expected by chance (i.e., from the availability pool), with Chemistry, Math and Physics accounting for most of the underutilization (8.25 FTE). Since 6.25 FTE represents only 1.5% of the faculty in these 11 departments, however, the shortage of women faculty seems much more severe than when assessed by the availability pool, especially because of the rising percentage of women students in the fields.

The same UCB campus report gives data only on "underutilization" of ethnic minority faculty, disregarding those few situations (if any) where the departments have more ethnic minority faculty than expected (by their proportion in the availability pool) and ignoring situations where underutilization is by less than 0.30 FTE (i.e., the equivalent of a half-time faculty member). Summing across the 11 departments, the "underutilization" of ethnic minority faculty calculates to 20.30 FTE Asians, 2.77 FTE Blacks, and 1.29 FTE Hispanics. (Much of the underutilization of Asians--9.21 FTE--is in Civil Engineering.)

In the 12 programs, the proportion of upper division students in Fall 1979 who were Blacks and Chicanos--the groups with the greatest underrepresentation compared to the California population--was 1.2% and 1.3%, respectively.

These data are presented here so that students and faculty alike may gain a better appreciation of the numerical reality of the affirmative action situation in Engineering and the Physical Sciences and perhaps appreciate to a greater extent the importance of the students' opinions about whether there are "enough" women or ethnic minority faculty members, and students, in their programs.

COMPETITION, TESTING, GRADING AND GPA

In the Engineering and Physical Sciences Sample, the ratings indicated that the grading was extremely rigorous--more severe generally than in the humanities and social sciences (but about equivalent with that found in the health-related sciences) [page 38]. De facto, the grading is all the more rigorous in view of the amount of work required to get a good grade (see also the recommendations concerning "Student Workload," below). Yet there were highly significant differences between some of the overall GPAs found among respondents from the various programs, with little or no apparent rhyme or reason for them. In the survey, the best predictors we could find of the student's overall GPA at UCB were ratings of the (relative) ease of grading in the student's own program, the student's capacity to cope with competition, and the student's overall satisfaction with their major program--while there was virtually no relationship to two workload measures or to a rating of how well students would remember what they had learned [pages 40-41]. Clearly, the award of grades needs a thorough review, especially in departments with high workloads and relatively stringent grading standards.

One possible element of a solution to the problem of grading is to put more emphasis on "absolute," mastery, or workload standards (such as used in self-paced courses). This approach requires clarity (and planning) about what is to be learned and a knowledge of how much work is involved for the student. Currently, however, faculty in most courses weren't particularly clear at the outset about what students would need to know or do to get an "A" grade (and they should in any case be clearer, sooner). But tests were usually seen (though seldom strongly so) as providing fairly accurate measures of what students had learned [pages 36-37].

But in the engineering departments (only inquiry), students tended to feel that time pressures on exams had unjustly influenced their grades [page 37], with the implicit recommendation that faculty should include less material in many of their tests. While engineering majors rated their likely retention of the material learned as lower than students did in the physical sciences and other disciplinary areas [page 57], the engineers (only inquiry) tended not to favor the use of "absolute" standards and exams stressing fundamentals (rather than details) [page 39]. Instead, they (only inquiries) recognized that detailed homework made an important contribution to their learning [page 55] and tended to want the homework counted more in the determination of final course grades [page 39]. Giving greater weight to homework in course grading involves more emphasis on a mastery or workload approach and would also stimulate the kind of teamwork that will often be found subsequently in the world of work, thereby reducing competition (a problem for a large minority of students) [page 34]. Hence, it seems appropriate to recommend additional credit be given to homework in course grading practices. (Better feedback on how students did on their homework was also suggested orally by some EJC members.)

STUDENT WORKLOAD

Based on the early returns from this evaluation, the Engineers Joint Council (EJC), in its June 1, 1980 letter to the Representative Assembly of the Berkeley Division of the Academic Senate [see Appendix E], put forward (or supported) the recommendation that unit values should accurately reflect student workloads. Since this evaluation showed that student workload in many of the program's courses exceeds Academic Senate standards [page 42], the need to follow the EJC's recommendations is clear. (Implementing this recommendation would help also to solve Berkeley's FTEness problems--see page 43.)

Certain of the courses in four of the engineering departments were identified specifically as having workloads that were too high in comparison to the number of units awarded [page 47 and Appendix B]. But these concrete examples suggest that the typical high-workload course is more likely to be undervalued by less than one whole unit, which somewhat complicates any process of adjustment. (In sequence courses--e.g., an A-B-C series--where there is some undervaluation in each, the solution is easier: the extra content can be concentrated in one course within the sequence and its unit value can/should then be increased by one whole unit.)

Since the Divisional Committee on Courses of Instruction has guidelines by which it assigns unit values (see page 42), the restructuring of workloads in some courses may need to occur within the Committee's guidelines. Alternatively, it is clear that the Committee's guidelines are a bit too rigid, so that, if nothing else, the Committee should entertain the idea of making exceptions where workload is demonstrated to be greater than the unit value.[1]

While students' views would vary according to which course was being considered, in general the engineering respondents (only inquiries) were open to a modest extent to modifications in courses by: reducing the homework (where it is too detailed), reducing the breadth and/or depth of coverage in required courses which are of low priority to the program, and reducing labwork in required courses. Clearly, most adjustments of this type in particular courses should be thoroughly discussed with the majors (although the problem in sequence courses may be fairly easy to solve, as noted above). Since students who have just completed a particular course may be especially helpful in providing information in this regard, professor-and-course evaluation surveys should be used not only to assess workload in courses where it has not yet been assessed but also, in courses where workload is too high, to obtain student opinion about what portions of courses might best be modified, omitted, or transferred to other courses. (These two types of questions can be asked at the same time on a properly-constructed end-of-course evaluation survey.) This recommendation, then, applies to all of engineering and the physical sciences.

Much the same procedure as described above should be used in the non-engineering programs, but in these instances the problem will be much simpler to solve because the required coursework as a whole does not involve so much of the current 180 unit minimum graduation requirement. For example, if a course is assigned 3 units and is estimated to be worth 3.47 units, it should be a simple matter to assign 0.53 units worth of additional work (and change the valuation of the course to 4 units--provided the Committee on Courses assents) or to remove 0.47 units worth of work, transferring the material to some other course, and leaving the existing unit value as it stands.

Students in the several engineering programs (only inquiries) expressed somewhat different priorities in terms of the types of adjustments that should be made in their program if 5-10 of the lower and upper division courses required for their major were to have their unit values raised by one unit each [pages 50-56]. These differing priorities should be considered closely in any adjustments of course content and unit values that might be undertaken. But the most generally favored approach to the problem (i.e., if units were raised in 5-10 of the students' courses) was simply to raise the number of units required for the degree (i.e., assuming that there is no net increase in actual workload for the student but simply that unit values would reflect more accurately the work currently undertaken). In addition, based on the item about lower division prerequisites [page 2], there may be room to maneuver within the current 180 unit minimum if there is a course or two at the lower division level that currently is, but need not be, a prerequisite, as was suggested in the responses of students in most of the engineering programs. The second-highest priority strategy for dealing with the impacts of (possibly) rising unit values on the programs as a whole was to "leave things as they are" (i.e., despite the undervaluations). These two responses, taken together, seem to suggest that the worst undervaluations of course unit values should be remedied, but that more marginal overloads in student workload might best be ignored. The EJC letter previously cited [Appendix D] also adopted this view.

Under the entire set of circumstances here--including the low programmatic impact of upward unit re-evaluations of courses in the L & S physical science programs and the somewhat differential views of students in the engineering programs--perhaps the campus should allow for the possibility that the Bachelor of Science (B.S.) degree might require a minimum somewhere between 180 and 190 units (the exact choice to be made by the department), while the 180 unit requirement would remain standard for the Bachelor of Arts (B.A.) degree.

[1] In a few undervalued courses with laboratory sections, it might be possible to achieve a more appropriate match between student workload and the unit values, within the Committee on Courses' guidelines, by adding one hour of laboratory, increasing the workload slightly, and awarding an additional unit.

STUDENT PARTICIPATION IN DEPARTMENT/PROGRAM DECISION-MAKING

If one sits down to examine the areas that have emerged as problems in this evaluation and then tries to think of ways in which improvements or solutions may be pursued, one is often and naturally drawn to recommend that program faculties work with their students in the search--if only because the students are typically the most important source of information about the specific directions that improvements must take. Thus various forms of joint, faculty-student work on problem areas have been recommended throughout this section.

In addition, from results on (other) questionnaire items specific to student participation [pages 68-75], the following recommendations can also be derived:

1) Each program should (even if it already does) include undergraduates on most committees, provide an office, allow a quarterly mailing, etc., to facilitate undergraduate organizing and input. With regard to the specific areas of departmental decision-making in which to involve students, faculty and students in each program should review the UCB Administration's "Preliminary Berkeley Campus Plan for Student Participation in Governance," and faculty should agree, if only on an experimental basis, to include students at least in the types of decisions and in the representative fashions suggested therein.

2) To enable the full spectrum of student views and concerns to reach the decision-making process, committee memberships, and agendas and background materials under consideration by program committees should be posted outside the program office in advance of committee meetings.

3) Since notice of at least one meeting of their general undergraduate organization never was received by a large minority of the respondents, each program and its student organization should work together to develop a timely and effective means of notifying all students of such meetings, with a general notice going out at least once a quarter.

METHODOLOGICAL SUMMARY

Introduction: Samples, Item Wordings, Data Tables

The programs and groups included in the sample(s) are summarized on the following page, with additional information provided in Appendix A (pages 1-10, 12-13).

In the discussions in the text, questionnaire items are often referred to in an abbreviated form. Item wordings are given in full in the adjacent data tables or, for the supplementary department-specific questionnaires, in Appendix B. The principal survey instruments, the Undergraduate Major Program Evaluation Questionnaire (UMPEQ) and Engineering Supplement (ESQ) are given as Appendix C (with item numbers cited in brackets within the data tables).

For all program-evaluative items in the UMPEQ and ESQ, a full table of the results is presented. Results from the departmental supplements, which are printed in this script, are cited in the text or, when summarized in tables, presented in Appendix B. Whenever there are significant differences (see below) between the assessments of students enrolled in (two or more of) the 12 programs evaluated, these are invariably noted in the text. An overview of how to read the data tables is given on page 11 of Appendix A.

Following below is a synopsis of the key methodological and interpretive strategies used in the data tables and text.

Methods and Interpretations

1. Response Rate(s); Representativeness; Reliability of Data. The response rate for the survey as a whole was 54.2% (gross); excluding students who moved and left no address (never received a questionnaire), the response rate was 57.9% (net). For more information, including response rates by program, see page xxv and Appendix A, pages 1-2. When compared with the original sample drawn from the OAR's list of majors, there does not appear to be any substantial bias in the population of respondents as contrasted with nonrespondents (see Appendix A, pages 1-4). A special study of rater and UMPEQ item reliabilities showed that the raters and items were reasonably reliable and, more importantly, that a retest of some respondents three months later produced almost no change whatever in the mean ratings of the items (see Appendix A, pages 15-23).

2. Calculation of Item Means and Percentages. Means and percentages are calculated after excluding the response category "Don't Know or Not Applicable" as well as blanks (nonresponses). However, a special footnote is means if 25% of more of the respondents did not give applicable responses. (The "liberal" approach used here is generally more than counterbalanced by the "conservative" approach described in point #4 below.)

3. Format for Reporting Percentage Responses. Most of the UMPEQ and ESQ items are designed in a 1-5, scaled format. The scaled response categories typically consist of: 1= "Strongly Disagree"; 2= "Disagree"; 3= "In Between"; 4= "Agree"; and 5= "Strongly Agree." In the text, THE WORDS "agree" or "agreement" REFER TO A COMBINATION OF THE 4TH AND 5TH RESPONSE CATEGORIES noted above, and "disagree" or "disagreement" REFER TO A COMBINATION OF THE 1ST AND 2ND RESPONSE CATEGORIES. Whenever the treatment in the text deviates from this pattern (or different response categories or scales have been used), a footnote calls the reader's attention to the situation.

4. Systematic Use of Language. The adjectives used in the text to describe the strength of (the applicable) student responses are systematically ordered thusly: "overwhelming majority" means that upwards of 80% of the respondents chose the two "agree" or "disagree" responses; "very large majority" = 70-80%; "large majority" = 60-70%; "majority" = 50-60%; and "plurality" means that the percentage of agree responses exceeds that for disagree responses, or vice-versa. While non-applicable responses have been excluded (see point #2), the percentage of students choosing the middle response (typically "In Between") continues to be a factor in the choice of modifiers (i.e., the adjective chosen refers only to two of the five points on the scale). Thus the language used in the text is quite conservative. In the summaries associated with each section, however, interpretation is based primarily on an "absolute" perspective (see Appendix A, page 14) focused on the mean rating for each program, and "problems" are flagged whenever the responses are not fairly positive.

The language applied to differences between the highest and lowest mean ratings of the various aspects of the 12 programs also is employed systematically. Differences between mean ratings on the typical 1-5 scale are termed "large" if they range from 1.51 to 1.75 points (38-44% of the scale length), "considerable" if they range from 1.76 to 2.00 (44-50% of the scale), and "very substantial" if they are between 2.01 and 2.25 (50-56% of the scale). Smaller differences are cited without such qualifying adjectives, except to indicate statistical significance.

5. Statistical Tests. Presented in both the text and in the data tables are results of tests for whether there are "statistically significant" differences in the mean ratings (between two or more) of the 12 programs. These results are presented in part in terms of probability figures. Probabilities of less than .0500 (e.g., .0084 but not .0791) are usually regarded as indicating that a real difference exists between at least two of the mean ratings (i.e., that the results obtained probably did not occur by chance alone). (See Appendix A, page 14.)

In the data tables alone, more specific results are presented in terms of the "confidence intervals" associated with the mean rating for each program (column headed by "95% Conf."). Roughly speaking, a confidence interval of ±0.31 (for example) indicates that there is a 95% probability that the "true" mean falls within "plus-or-minus" 0.31 points (on the scale) from the mean obtained in the current sampling (as reported in an adjacent column). If the confidence interval range (e.g., 3.44 to 4.06 if the mean is 3.75 ± 0.31) for the rating of a particular program does not overlap with the confidence interval range of the mean rating for any other program (e.g., 3.00 ± 0.35), the means are said to be "significantly" different. Where the confidence interval ranges do overlap, it is usually not very safe to attribute any meaning to the observed (apparent) differences. (See Appendix A, page 14.)

6. Engineering and Physical Science Totals. Because some upper division programs in engineering and the physical sciences were excluded from the sample, the totals (means, percentages) do not perfectly characterize this entire area of UCB's programs. Nor, because of the varying proportions of majors sampled, do they represent the total for all students in the 12 programs. The totals are based on the sum of the individual (and applicable) responses (and thus also are not the average of the 12 programs, weighted equally). In most cases, however, the differences would be very small between the totals reported and any of these three aggregations. (See Appendix A, page 12.)

SUMMARY OF SAMPLES

Title of Program or Group	Prog. Abbv.	Net Resp. Rate[1]	Total No. Resp.	Number of Respondents in Analyses: Usable TMPSO*	Usable FSO*	Usable Dept'l.	Apparent Representativeness[2]
Chemistry	Chem	54 %	49	37	—	—	Good
Chemical Engg	ChemE	48 %	67	62	58	59	Good
Materials Sci. & Engg	MSE+	60 %	30	25	24	24	Very Good; 30% double majors
Nuclear Engg	NuclE+	76 %	31	24	24	—	Very Good; 92% double majors
Civil Engg	CivilE	56 %	79	77	77	77	Very Good
Mechanical Engg	MechE	64 %	92	87	85	85	Very Good
Elec. Engg & Computer Sci.s	EECS	58 %	80	74	74	—	Very Good
Indus. Engg & Operations Research	IEOR	52 %	24	21	21	—	Very Good
Computer Sci. (Letters & Science)	LSComp	56 %	54	54	—	—	Very Good
Mathematics (excl. Applied Math)	Math	60 %	41	38	—	—	Very Good
Physics	Physic	63 %	46	40	—	—	Very Good
Geology	Geol	64 %	27	26	—	—	Very Good
Transfer w/in engg	*XsferE	—	—	22*	22*	—	—
Transf. w/in, to/from L&S/Chem	*XsfLSC	—	—	24*	—	—	—
SUBTOTAL, ENGG & PHYSICAL SCI.S		57.9%	620	611	385	245	Very Good
Social Science-related Progs.	*Soc579	54.1%		496			Good
Health-related Science Progs.	*Hlt577	58 %		438			Very Good
Selected Humanities (1977)	*SHum77	59 %		284			Selected samples and sizes

[1]The "net" response rate is calculated after excluding students who moved and left no forwarding address (i.e., such that their questionnaire never reached them). For more information, see Appendix A, pages 1-2.

[2]See Appendix A, pages 1-4 and page 13 (comparison samples) for more information.

*Students who returned questionnaires but indicated that their program was not the same as indicated in the OAR list were removed from the program samples, and two groups of major-transferrers were created: 1) "*XsferE"—transfers between the seven engineering programs; and 2) "*XsfLSC"—transfers between L&S physical science programs or the Chemistry Department, or from these to an engineering program, or from an engineering program to these. See Appendix A, page 12, footnote "**" for more information. In addition, nine responses were unusable (see Appendix A, pages 1-2).

All programs prefaced by an asterisk ("*") are excluded from reported totals (percentages, means) and from the tests for differences between program ratings.

EVALUATIVE FINDINGS

INTRODUCTION

Organization of the Report. The principal sections of the Report are as follows: Summary of Findings (p. ix), Recommendations (p. xvii), Methodological Summary (p. xxiv), Summary of Samples table (above), Evaluative Findings (p. 1), and Appendices A through F.

Within the Evaluative Findings section, there are major headings concerned with Curriculum (p. 2), Teaching and Faculty-Student Interaction Outside the Classroom (p. 18), Affirmative Action (p. 31), Competition, Testing, Grading and GPA (p. 34), Student Workload (p. 42), Student Learning (p. 56), Provision of Information to Students (p. 60), Student Participation in Program Decision-Making (p. 68), Influences on Students' Overall Growth and Learning (p. 76), and Overview of Department/Program Contributions (p. 79).

The Table of Contents (p. iii) and the cover memo will provide further guidance regarding the structure of the Report.

Understanding the Report. The data and analyses are presented in ways that should minimize the need for sophistication in social science or survey methods. Nevertheless, I would urge the reader to note how the means are calculated, as well as the systematic usage of the words "agree" and "disagree" and "plurality" and "majority" (see points 2-4, page xxiv).

EVALUATIVE FINDINGS

CURRICULUM

CURRICULAR STRUCTURE

The various aspects of undergraduate programs which are examined in this report are limited (or defined operationally) by the content of items included in the Undergraduate Major Program Evaluation Questionnaire (UMPEQ), or in the Engineering Supplement (ESQ), or in one or more of four departmental supplements. The items concerning the "structural" aspects of the major programs focus on: the number of lower division prerequisites; the number of required courses and, in the College of Engineering, the effectiveness of the depth requirement in the humanities or social studies; the availability of separate curricular patterns of required courses, or options, within the program; the integration of the curricular offerings; the sufficiency in number of small classes and the instructional adequacy of large classes; and course scheduling or availability.

Lower Division Prerequisites. Across all 12 engineering and physical sciences programs, a plurality of the respondents disagreed (S.D. 19-28/13/28-12% S.A.)* that some of the lower division prerequisites were not necessary for the upper division program [UMPEQ #39]. However, in six of the seven engineering departments (excluding only Nuclear Engineering), a plurality or more of the respondents agreed that there were some unnecessary lower division prerequisites, while at least a majority disagreed in all the L & S departments and programs, and in Chemistry. At one extreme, a large majority (5-19/10/38-29) of the IEOR students viewed some of their lower division prerequisites as unnecessary; a majority also agreed in Civil Engineering (7-24/16/39-14) and EECS (10-27/12/38-12), as did pluralities in Materials Science (16-28/8/20-28), Chemical Engineering (11-30/13/31-15) and Mechanical Engineering (17-23/14/30-16). At the other extreme, a "considerable" distance away, an overwhelming majority of students in Physics disagreed (55-29/3/13-0). Large majorities also disagreed that some of their lower division prerequisites were unnecessary in Math (44-17/11/17-11), Chemistry (22-42/17/17-3) and L&S Computer Science (26-35/11/20-7). The differences were statistically significant between almost all of the programs where a plurality or more agreed as contrasted with those where a large majority disagreed [F-prob.= .0000].

Item: Some of the lower division prerequisites are not necessary for the upper division program. [UMPEQ Q39]. [1977, 1979 wording: ~~upper division program~~ major.]

TOTALS — Engineering and Physical Sciences

19% Str. Disagree, 28% Disagree, 13% In Between, 12% Str. Agree, 28% Agree

Mean: 2.86 ± 0.11 (349) F-probability = .0000

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
Physic	1.74	± 0.34	(38)	LSComp	2.48	± 0.33	(54)	Geol	2.76	± 0.47	(25)	MSE+	3.15	± 0.53	(25)
*SHum77	2.17	0.14	(241)	*SocS79	2.51	0.11	(462)	*XafLSC	2.92	0.60	(24)	EECS	3.16	0.29	(73)
Math	2.33	0.50	(36)	*HltS77	2.64	0.12	(421)	MechE	3.05	0.30	(83)	CivilE	3.25	0.27	(74)
Chem	2.36	0.37	(36)	NuclE+	2.70	0.36	(23)	ChemE	3.08	0.33	(61)	*Xafer	3.30	0.55	(20)
												IEOR	3.67	0.36	(21)

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Number of Required Courses. Although a bare majority of the entire sample disagreed (S.D. 6-44/24/17-9% S.A.)* that there were too many courses required for their major, a plurality of respondents agreed in five of the seven engineering departments [UMPEQ #42]. Disagreement was by overwhelming majority in Math (17-69/14/0-0), by large majority in L&S Computer Science (9-53/34/4-0), EECS (3-59/26/8-4) and Chemistry (0-66/17/11-6), and by majority in Geology (12-44/24/

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

12-8) and Physics (15-38/25/18-5%). The number of required courses was significantly less burdensome in Math and L&S Computer Science than in six of the seven engineering departments, and EECS and Chemistry were also rated significantly better than one to three of these same six [F-prob.= .0000]. The programs in which students were most likely to feel there were too many required courses included: Chemical Engineering (6-29/23/19-23), Nuclear Engineering (9-26/22/26-17), Materials Science (0-33/29/25-13), Civil Engineering (5-31/21/28-15), IEOR (5-35/15/40-5) and Mechanical Engineering (2-39/29/20-10).

Item: There are too many required courses for the major. [UMFEQ #42].

TOTALS — Engineering and Physical Sciences

6% Str. Disagree, 44% Disagree, 24% In Between, 9% Str. Agree, 17% Agree

Mean: 2.79 ± 0.09 (549) F-probability = .0000

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
Math	1.97	± 0.19	(36)	*HlthS77	2.30	± 0.09	(430)	Physic	2.60	± 0.35	(40)	IEOR	3.05	± 0.51	(20)
*SocS79	2.13	0.08	(479)	EECS	2.52	0.20	(73)	*XsferE	2.95	0.38	(20)	CivilE	3.16	0.27	(75)
LSComp	2.32	0.19	(33)	Chem	2.57	0.31	(35)	*XsfLSC	2.96	0.32	(24)	MSE+	3.17	0.44	(24)
*SHum77	2.37	0.12	(278)	Geol	2.60	0.46	(25)	MechE	2.96	0.23	(83)	NuclE+	3.17	0.55	(23)
												ChemE	3.23	0.32	(62)

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

If the engineering students' programs happen to be caught in a squeeze by an increase in unit values for 5-10 of their courses (e.g., each by one unit), however, there was considerable reluctance to lower the number of required upper division courses in the major, and a reduction in the number of required courses in the humanities and social sciences wasn't a particularly welcome solution either (see pages 50-55). Thus the results on the item about whether there are too many courses required for the major may refer more to the lower division requirements (see page 2) and/or to the total, general sense of being overburdened by many required courses. One possible contributor to such a sense of burden is discussed in the subsequent paragraph.

In the College of Engineering, a majority of all the respondents disagreed (S.D. 19-32/20/22-8% S.A.) that the College's depth requirement in a single humanities or social studies department (for three courses, at least one in upper division) is more effective educationally than permitting more freedom of choice [ESQ #8]. Although there were no statistically significant differences between the department ratings [F-prob.= .1555], with a plurality to large majority of the respondents typically disagreeing, the response in IEOR, where a bare majority agreed (0-39/11/33-17), seemed somewhat unique. Thus despite the flexibility of this requirement, the respondents preferred more freedom of choice.

Item: College of Engineering Students: The humanities/social sciences depth requirement for three courses, at least one in upper division, to be completed in the same department, is more effective educationally than permitting more freedom of choice. [ES Q8].

TOTALS — Engineering

19% Str. Disagree, 32% Disagree, 20% In Between, 8% Str. Agree, 22% Agree

Mean: 2.67 ± 0.13 (273) F-probability = .1353

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
NuclE+	2.40	± 0.63	(20)	ChemE	2.50	± 0.74	(12)**	CivilE	2.65	± 0.27	(65)	MSE+	2.84	± 0.58	(19)
MechE	2.46	0.31	(70)	*XsferE	2.60		(20)	EECS	2.83	0.29	(69)	IEOR	3.28	0.39	(18)

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

The reader is referred to page 12 for a multi-faceted, four-department discussion of technical writing courses.

In Chemical Engineering, a number of courses were rated individually as to their viability as requirements (and in amplification of the results noted above), with the following results:

1) A majority of the Chemical Engineering respondents agreed (S.D. 13-21/13/42-11% S.A.) that Chem 5 (Quantitative Analysis) should continue to be a requirement for the major [ChEQ #1].
2) A plurality disagreed (25-20/19/29-7) that Chem 110A (Physical Chemistry) should continue to be a requirement for the major [ChEQ #3].
3) A large majority agreed (9-13/15/43-20) that Chem 111 (Physical Chemistry Lab) should continue to be a requirement for the major [ChEQ #4].
4) A large majority agreed (0-20/20/34-26) that Chem Engineering 162 (Dynamics and Control of Chemical Processes) should be a requirement for the major [ChEQ #15].
5) A weak plurality disagreed (11-30/23/21-14) that Chemical Engineering majors should be required (and not just strongly recommended) to take one or more specific courses in other engineering departments [ChEQ #16].

Also in Chemical Engineering, with regard to the structure of several other courses, the majors expressed the following views:

1) A large majority disagreed (43-25/4/14-14) that Chem Engineering 151A and 151B (Chem Engineering Lab, each 4 units) should be combined into a single course of 6 units, even assuming that the six written experiments with 3-person teams (as currently required) were reduced to four with 2-person teams [ChEQ #7].
2) A large majority agreed (5-12/19/30-33) that Chem Engineering 150 (Fluid Mechanics and Heat Transfer) should be split into two courses [ChEQ #5]. Assuming Chem Engineering 150 was divided into two courses, an overwhelming majority agreed (42-42/11/4-2) that Fluid Mechanics should be taught in the Department of Chemical Engineering [ChEQ #6A]; a plurality disagreed (34-15/21/19-11) that Heat Transfer should be taught in Mechanical Engineering [ChEQ #6B].

Location of Chemical Engineering Department. A very large majority of the respondents in Chemical Engineering disagreed (50-21/10/10-10) that the Chemical Engineering Department should be in the College of Engineering [ChEQ #19].

Enough Course Plan Options? In most of the programs, a plurality or more of the respondents were satisfied with the number of course plan options by which to pursue their major; overall, a majority agreed (S.D. 7-21/15/43-14% S.A.) that there were enough options. But satisfaction in this regard was significantly higher in EECS (4-8/12/50-26) than in IEOR (16-26/16/26-16), Materials Science (20-24/8/32-16), Chemical Engineering (7-33/17/33-10), L&S Computer Science (8-24/24/35-10) and perhaps Geology (8-36/4/36-16) [UMPEQ #40; F-prob.= .0051].

Item: There are enough course plan options within the department/program to meet my specialized interests in the subject matter. [UMPEQ Q40.] [1977 wording: within the department/program . . . in the subject matter in the major.]

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
*SHum77	2.81	± 0.16	(272)	LSComp	3.16	± 0.32	(31)	Math	3.37	± 0.39	(35)	MechE	3.52	± 0.22	(83)
IEOR	3.00	0.46	(19)	Geol	3.16	0.54	(25)	*XsfLSC	3.38	0.54	(24)	*HisS77	3.54	0.11	(419)
MSE+	3.00	0.60	(25)	Physic	3.26	0.42	(38)	CivilE	3.45	0.23	(73)	*XsferE	3.64	0.30	(22)
ChemE	3.07	0.30	(60)	NuclE+	3.30	0.39	(23)	Chem	3.49	0.37	(37)	*SocS79	3.72	0.11	(477)
												EECS	3.85	0.24	(74)

TOTALS -- Engineering and Physical Sciences

7% Str. Disagree, 21% Disagree, 15% In Between, 14% Str. Agree, 43% Agree

Mean: 3.37 ± 0.10 (343) F-probability = .0051

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

In Mechanical Engineering, which was second-highest ranked on student satisfaction with the availability of curricular options (S.D. 2-19/16/49-13% S.A.), students were also asked specifically whether an undergraduate degree in M.E. should continue to ensure competency in all the diverse subfields rather than permitting students to specialize more extensively. A majority of the respondents preferred the current requirements for breadth in M.E. (4-26/15/40-15) [MEQ #3].

Integration of Curriculum. Overall, a very large majority of the respondents disagreed (S.D. 15-55/20/8-2% S.A.) that it was hard to get a good perspective on the field; that the courses do not relate well to each other [UMPEQ #43]. Disagreement was by at least a majority in every program but one. But the curriculum was most clearly integrated in the non-engineering departments--Geology (25-63/8/4-0), Chemistry (28-53/17/3-0), Physics (28-51/13/5-3) and Math (22-54/22/3-0)--and it was significantly less so, though still not very fragmented, in Materials Science (8-40/32/12-8), IEOR (10-52/19/14-5), Nuclear Engineering (21-42/21/8-8) and EECS (6-59/24/12-0) [F-prob.= .0000].

Item: The courses in this program do not relate well to each other; it is hard to get a good perspective on the field. [UMPEQ Q43].

Prog.	Mean	95% Conf.	N
Geol	1.92	± 0.30	(24)
Chem	1.94	0.26	(36)
Physic	2.03	0.30	(39)
Math	2.05	0.25	(37)
*HltS77	2.23	± 0.09	(422)
CivilE	2.24	0.16	(74)
*XsferE	2.29	0.33	(21)
ChemE	2.30	0.24	(61)
MechE	2.30	± 0.18	(86)
*XsfLSC	2.30	0.44	(23)
*SocS79	2.31	0.10	(476)
LSComp	2.31	0.24	(54)
*SHum77	2.33	± 0.12	(265)
EECS	2.41	0.19	(68)
NuclE+	2.42	0.50	(24)
IEOR	2.52	0.47	(21)
MSE+	2.72	0.44	(25)

TOTALS — Engineering and Physical Sciences

15% Str. Disagree, 55% Disagree, 20% In Between, 2% Str. Agree, 8% Agree

Mean: 2.26 ± 0.07 (549) F-probability = .0062

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

In Materials Science, the 11 double majors' responses to two other questions tended to confirm the above results indicative of borderline success in curricular integration. A plurality agreed (S.D. 0-18/36/27-18% S.A.) that the coursework for their two majors overlapped very little [MSEQ #4A], and a tentative majority agreed (0-18/27/54-0) that the coursework for their two majors is complementary, resulting in an effective synthesis of the two programs [MSEQ #4B].

Coordination of Prerequisites in Mechanical Engineering. A majority of the M.E. majors disagreed (S.D. 9-47/24/18-2% S.A.) that too many M.E. classes are taught "as if I knew essential background material from other courses which are not listed as prerequisites (or even as recommended)" [MEQ #4].

Class Size. As we have found in most other undergraduate major surveys at UCB, a majority of the respondents in Engineering and Physical Sciences disagreed (S.D. 19-33/23/23-2% S.A.) that large lecture classes can generally provide adequate learning opportunities in their field [UMPEQ #46]. Though the responses in one department were almost evenly divided, the only significant differences in the distribution resulted from the overwhelming strength of the disagreement by students in Geology (64-28/4/4-0), where the mean rating was below that of all the other programs [F-prob.= .0004].

Item: Large lecture classes can generally provide adequate learning opportunities in this field. [UMPEQ Q46].

Prog.	Mean	95% Conf.	N
Geol	1.48	± 0.32	(25)
NuclE+	2.45	0.45	(22)
MechE	2.46	0.23	(81)
EECS	2.49	0.24	(72)
*XsfLSC	2.50	± 0.34	(22)
*SHum77	2.54	0.16	(210)**
*SocS79	2.54	0.10	(469)
IEOR	2.56	0.60	(18)
CivilE	2.64	± 0.22	(75)
Chem	2.68	0.42	(34)
*XsferE	2.68	0.56	(19)
Math	2.69	0.44	(32)
LSComp	2.70	± 0.34	(33)
MSE+	2.73	0.30	(22)
*HltS77	2.73	0.10	(400)
ChemE	2.75	0.30	(60)
Physic	2.92	0.38	(38)

TOTALS — Engineering and Physical Sciences

19% Str. Disagree, 33% Disagree, 23% In Between, 2% Str. Agree, 23% Agree

Mean: 2.57 ± 0.09 (532) F-probability = .0004

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

There was a "large" variation in the results, however, concerning whether the curriculum was structured so that all majors would have a sufficient number of small classes [UMPEQ #47; F-prob.= .0000]. Overall, a narrow plurality agreed (S.D. 9-25/26/34-5% S.A.) that there were enough small classes in their program. But a large majority of the respondents disagreed in L&S Computer Science (21-43/17/17-2), and pluralities were also dissatisfied in EECS (14-36/34/17-0), Civil Engineering (10-32/27/29-2) and Chemical Engineering (13-33/19/29-6). In contrast, satisfaction with the number of small classes was manifest overwhelmingly in Geology

(0-4/9/61-26), and by large to very large majorities in Math (0-6/28/53-13) and IEOR (0-19/6/69-6). Chemistry (7-18/25/39-11) also was rated significantly higher than L&S Computer Science and EECS, but below Geology. With pluralities agreeing, Materials Science (11-11/37/32-11%), Nuclear Engineering (11-6/50/28-6) and Mechanical Engineering (3-23/37/35-2) also tended to be significantly above L&S Computer Science, but at the same time were significantly lower than one to three of the programs where satisfaction with the number of small classes was highest.

Item: The curriculum is structured so that all majors will have a sufficient number of small classes or seminars. [ChEQ Q47]. [1977 wording: classes ... .]

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
LSComp	2.36	± 0.34	(42)	CivilE	2.81	± 0.26	(62)
*XsfLSC	2.30	0.43	(18)**	ChemE	2.83	0.34	(48)
*ElecS77	2.31	0.12	(298)**	*SocS79	2.92	0.11	(415)
EECS	2.54	0.24	(59)	Physic	3.03	0.41	(32)

TOTALS — Engineering and Physical Sciences

9% Str. Disagree 5% Str. Agree
25% Disagree 26% In Between 34% Agree

Mean: 3.01 ± 0.10 (439) F-probability = .0000

Prog.	Mean	95% Conf.	N
*SEcon77	3.07	± 0.15	(220)
MachE	3.08	0.23	(60)**
NuclE+	3.11	0.31	(13)**
*XsferE	3.13	0.59	(15)**
MSE+	3.21	± 0.35	(19)
Chem	3.29	0.43	(29)
IEOR	3.63	0.47	(16)
Math	3.72	0.29	(32)
Geol	4.09	0.32	(23)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Coping with High Student Demand for Access to the Major: A Case Study of the Views of Chemical Engineering Students. The ASUC Academic Review Unit generally has been supportive of the view that the College/School or UCB Administration(s) should provide additional faculty, if only on a temporary basis, to departments which find themselves crowded with interested majors, and has opposed extra-restrictive requirements for entry to a major or, especially, modifications of curriculum which are designed to deter demand. However, we have often noted also that laboratory sciences may pose special problems in this regard, especially since the turnaround time for building new laboratories may be five years, even if planning, fund acquisitions and construction proceed at a rapid pace. Consequently, it was with special interest that we awaited responses of Chemical Engineering majors to a battery of questions about how they would deal with the problem of overcrowding, where increasing the number of faculty was not included as a possible option. First, however, we sought estimates of the students' views about the current level of enrollments.

In Chemical Engineering, a majority of the respondents agreed (S.D. 4-11/30/30-26% S.A.) that the Department should do its best to accommodate all students who are interested in majoring in Chemical Engineering [ChEQ #20]. The extent of crowding currently was apparently not too severe for most of the majors, since a plurality disagreed (19-19/35/18-9) that the Department should accept fewer students into the major [ChEQ #21].

Subsequently, the questionnaire went on to ask the extent to which the Department should use 10 different possible ways of limiting enrollment in the major if it were necessary to do so [ChEQ #22A-J]. The full results of this inquiry are presented in tabular form in Appendix B. Three of the possible ways of (or criteria for) restricting enrollments received more approval than the others, with a mean response equal to the middle response category, "Use Some." These were: High School GPA (for students entering directly from high school); GPA at other colleges and universities (for transfer students); and GPA at UCB (for students who have been at UCB for two or more quarters). Least acceptable as a criterion, with 66% responding "Do Not Use at All," was the possibility of increasing workload per unit in the coursework ("to deter interest"). While the mean response was the equivalent of "Use a Little," in percentage terms the students were divided almost equally between marking "Do Not Use at All" (response #1) and giving some weight (responses #2-5) to possible criteria such as extra-rigorous grading ("to discourage or even fail some students"), affirmative action-related concerns, and a requirement that students take a minimum of four courses per quarter ("except if they are working more than 12 hours per week at a job, or have equivalent outside responsibilities").

Course Scheduling and Availability. Overall, the respondents were of mixed views (S.D. 9-33/25/20-14% S.A.) about whether courses of interest to them were offered at the same time, crowded into one or two quarters, or not being offered this year [UMPEQ #45]. A large majority of the (94% double) majors in Nuclear Engineering agreed (8-13/17/33-29) that scheduling of courses was poor, as did a plurality of students in IEOR (5-26/21/26-21) and EECS (4-25/32/23-16). These results tended to be significantly worse than those observed in Physics (23-38/20/18-3) and Math (3-56/19/22-0) [F-prob.= .0049]. But only in Physics and Math did more than a plurality disagree that scheduling of courses was poor.

Item: Scheduling of courses is poor in this program: Required courses or subjects of interest to me are offered at the same time, crowded into one or two quarters, or are not being offered this year. [UMPEQ Q45.] [1977 wording: ~~crowded into one or two quarters~~ in the same quarter . . .]

TOTALS — Engineering and Physical Sciences

9% Str. Disagree
33% Disagree
25% In Between
14% Str. Agree
20% Agree

Mean: 2.98 ± 0.10 (348) F-probability = .0049

Prog.	Mean	95% Conf.	N							
Physic	2.40	± 0.35	(40)	ChemE	2.83	± 0.30	(61)	MechE	3.00	± 0.28 (84)
Math	2.61	0.29	(36)	*WLitS77	2.97	0.11	(413)	Geol	3.08	0.48 (24)
*XsfLSC	2.82	0.49	(22)	CivilE	2.97	0.29	(74)	MSE+	3.12	0.51 (25)
Chem	2.83	0.41	(36)	LSComp	2.98	0.32	(52)	*SocS79	3.14	0.12 (467)

EECS	3.23	± 0.26 (73)
*SHum77	3.28	0.14 (270)
IEOR	3.37	0.60 (29)
*XsfarE	3.38	0.49 (21)
NuclE+	3.63	0.54 (24)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Summary of Problems by Program: Structure of the Major

A number of the programs evaluated, especially in the engineering departments, received relatively weak ratings on several items dealing with the structure of the major (including lower division prerequisites, number of required courses, number of options by which to pursue the major, class size, and course scheduling or availability).

IEOR MSE+ ChemE

In IEOR especially, but also in Materials Science and Chemical Engineering, a large minority of student ratings indicated that some of the lower division prerequisites were probably not necessary for the major, that there were perhaps too many courses required for the major (*Chem 110A being specifically questioned by Chemical Engineering students*), and that the number of options by which to pursue the major was perhaps too few. *While Chemical Engineering majors tended to prefer that the Department do its best to accommodate interested students,* they were somewhat dissatisfied with the number of small classes available to them (though problems in course scheduling or availability at least were fairly minor). IEOR students tended to indicate that there were some problems with course scheduling or availability, as did MSE students.

CivilE

Civil Engineering students expressed views much like those cited above, but there were few problems with the number of options for study within the field.

LSComp EECS

The overwhelming prevalence of large classes was identified as a problem among L&S Computer Science majors (especially). There was perhaps also a little dissatisfaction with the limited number of options by which to pursue the major and with the scheduling or availability of courses. Class sizes were also a problem in EECS. Also of concern to EECS students were the number of lower division prerequisites and the scheduling or availability of courses.

NuclE+

The (double) majors in Nuclear Engineering indicated that there were problems with the scheduling or availability of courses and perhaps with the number of courses required for the major.

MechE Mechanical Engineering students also raised some questions about the necessity of all of their lower division prerequisites and the total number of courses required for the major. The scheduling and availability of courses was as often as not a problem for the respondents.

Geol Geology students were not entirely satisfied with the number of options by which to pursue their major and the scheduling or availability of courses was perhaps not very satisfactory.

COVERAGE OF CONTENT IN THE MAJOR

A number of items in the UMPEQ inquired about the students' views on several elements of curriculum commonly found in most disciplines. Among the areas of inquiry were: the availability of advanced courses in students' areas of interest: the availability of courses to explore nondominant schools of thought: the sufficiency of opportunities for fieldwork, internships, group, lab, or other academic-experiential work for which credit is available; methodology, lab or technical courses--whether sufficiently up-to-date and not overemphasizing traditional values, and whether providing enough experience in real problem-solving and analysis: and the adequacy of equipment. In engineering only, items also focused on the balance generally between theory and application, and on the need for technical writing courses.

Crossreferences. In addition to the item in this section about the extent to which coursework is regarded as interesting and challenging, the reader is referred to the discussion of program contributions to students' acquisition of a "thorough understanding" of the subject matter (page 80) and the examination of the net influence of the instructional process (page 76).

Availability of Advanced Courses. Advanced courses were offered by the program (or otherwise available) in all areas of interest to a large majority of the Engineering and Physical Sciences respondents (S.D. 4-15/18/48-14% S.A.)* [UMPEQ #41]. By department, the level of agreement ranged from nearly overwhelming majorities, as in Civil Engineering (1-7/15/55-21), Physics (5-8/8/60-20) and Math (3-9/12/55-21), to a simple majority and a plurality, as in Materials Science (18-18/9/45-9), L&S Computer Science (10-18/24/37-10), Chemical Engineering (5-19/24/45-7), IEOR (5-20/20/50-5) and Mechanical Engineering (4-24/15/45-12). The mean rating for Civil Engineering tended to be significantly higher than these five programs [F-prob.= .0008].

Item: Advanced courses are offered in the major (or are otherwise available) in all of my areas of interest. [UMPEQ Q41].

Prog.	Mean	95% Conf.	N					
*SRes77	2.81	± 0.13	(247)	ChemE	3.29	± 0.27	(58)	
MSE+	3.09	0.60	(22)	IEOR	3.30	0.48	(20)	
LS Comp	3.18	0.34	(49)	MechE	3.36	0.25	(78)	
*Soc579	3.21	0.11	(456)	*KsfLSC	3.48	0.35	(23)	

TOTALS — Engineering and Physical Sciences

4% Str. Disagree, 15% Disagree, 18% In Between, 14% Str. Agree, 48% Agree

Mean: 3.33 ± 0.09 (526) F-probability = .0008

Chem	3.49	± 0.31	(37)	NuclE+	3.74	± 0.42	(23)
Geol	3.50	0.45	(24)	*KsferE	3.81	0.37	(21)
*HltS77	3.53	0.10	(389)	Math	3.82	0.35	(33)
EECS	3.70	0.23	(71)	Physic	3.83	0.32	(40)
				CivilE	3.87	0.21	(71)

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

In Chemical Engineering, which ranked third-lowest on ratings of the availability of advanced courses of interest to students (above), the supplemental questionnaire asked whether the majors would be interested in taking some advanced electives not currently offered at the undergraduate level [ChEQ #17], and a majority agreed (S.D. 8-12/22/34-24% S.A.). Interest in taking some advanced graduate seminars in Chemical Engineering, if the Department clearly welcomed undergraduates into the courses [ChEQ #18], was overwhelmingly positive (2-6/8/35-49).

Nondominant Schools of Thought. Despite efforts to adapt the examples in the questionnaire item to engineering and physical science students, only 59% of the respondents ventured a response as to whether there are enough courses available in their program which explore the contributions of the nondominant schools of thought (e.g., environmentalist, low-technology, etc.) [UMPEQ #52]. But some students may not answer because of insufficient familiarity with the full range of departmental offerings and course contents. Of those who did respond, overall, a bare majority disagreed (S.D. 20-30/30/17-3% S.A.) that courses were available which explored nondominant perspectives in their field. Though the confidence intervals for Geology, where agreement was highest (0-19/44/38-0, with 62% responding), did not overlap with those of four other programs, these differences in ratings were at best of borderline significance statistically [F-prob.= .1016]. Disagreement was highest in Chemistry (24-38/29/10-0, with 57% responding), Civil Engineering (23-38/25/12-2, with 68% responding) and Mechanical Engineering (29-29/23/17-2, with 60% responding). With the large faculties in many of the departments in engineering and the physical sciences, one should certainly have a right to expect better coverage of nondominant schools of thought than these ratings suggest is actually available, and a higher student awareness of their availability.

Item: There are enough courses available in this program which explore the contributions of the nondominant "schools of thought" (e.g., environmentalist, low-technology, radical, conservative, futurist, traditionalist, etc.). [UMPEQ Q52.] [1979 wording: ~~environmentalist, low-technology~~ feminist, Third World, etc.). 1977 wording adds an "s" to first four 1979 examples and ends with "women, minorities, etc.)."]

TOTALS — Engineering and Physical Sciences

20% Str. Disagree, 30% Disagree, 30% In Between, 17% Agree, 3% Str. Agree

*Mean: 2.82 ± 0.12 (332)** F-probability = .1016*

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
*XsferE	2.20	± 0.45	(10)**	MechE	2.35	± 0.32	(52)**	NuclE+	2.34	± 0.47	(13)**	L&SComp	2.30	± 0.38	(20)**
Chem	2.24	0.43	(21)**	ChemE	2.46	0.35	(46)**	*HlcS77	2.64	0.17	(172)**	Math	2.32	0.39	(11)**
*XsfL&C	2.25	0.60	(15)**	EECS	2.48	0.28	(42)**	Physic	2.65	0.44	(25)**	IEOR	3.00	0.62	(16)
CivilE	2.31	0.28	(32)**	MSE+	2.53	0.35	(17)**	*SHum77	2.66	0.17	(210)**	Geol	3.19	0.40	(16)**
												*Soc$79	3.27	0.12	(431)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

For related information, see also "Social Issues" (page 20) and "Social Responsibility and Skills Useful in the Community" (page 82).

Academic-Experiential Offerings Generally. With 72% of the possible respondents actually answering, views were rather evenly divided as to whether there are enough fieldwork, internships, group, lab, or other academic-experiential course offerings (and/or that credit is readily available for appropriate types of volunteer experience) [UMPEQ #48]. Overall, the response was: S.D. 11-26/24/32-7% S.A. Since the only divergent mean was in Math, where only 34% of the possible respondents could or did impute meaning to the item, there were probably no meaningful differences between the program ratings [F-prob.= .0244]. Apart from Math, disagreement prevailed only in L&S Computer Science (17-37/20/23-3), EECS (15-24/32/27-2) and Physics (16-26/23/35-0), but agreement never went above 50%.

Item: There are enough fieldwork, internship, group, lab, or other academic-experiential course offerings in this program, and/or credit is readily available for appropriate types of volunteer experience. [UMPEQ Q48]. [1977 wording: group.]

TOTALS — Engineering and Physical Sciences

11% Str. Disagree; 26% Disagree; 24% In Between; 32% Agree; 7% Str. Agree

*Mean: 2.97 ± 0.11 (409)** F-probability = .0244*

Prog.	Mean	95% Conf.	N
Math	2.00	± 0.55	(13)**
*SHum77	2.13	0.18	(161)**
LSComp	2.60	0.42	(30)**
*XsfLSC	2.67	0.43	(18)**
EECS	2.76	± 0.28	(59)
Physic	2.77	0.41	(31)
MechE	3.02	0.30	(62)**
*XsferE	3.07	0.64	(15)**
ChemE	3.08	± 0.35	(50)
CivilE	3.09	0.27	(35)**
NuclE+	3.10	0.55	(20)
MSE+	3.14	0.37	(22)
*SocS79	3.20	± 0.13	(383)
Chem	3.20	0.43	(30)
*HltS77	3.25	0.12	(366)
Geol	3.27	0.64	(22)
IEOR	3.33	0.50	(15)**

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Theory Vs. Application. In the engineering departments, the respondents were nearly equally divided, though leaning toward agreement (S.D. 3-25/35/26-10% S.A.), about whether there is too much emphasis on theory in most of their program's courses [ESQ #16]. While the ratings were fairly balanced in five of the seven programs (with total disagreement tending to have a plurality but with few disagreeing strongly), theory was seen as overemphasized in most courses in IEOR (0-21/21/37-21) and Mechanical Engineering (1-18/33/35-13) [F-prob.= .0311].

Item: I feel there is too much theory emphasized in most of my program's courses. [ES Q16].

TOTALS — Engineering

3% Str. Disagree; 25% Disagree; 35% In Between; 26% Agree; 10% Str. Agree

Mean: 3.15 ± 0.11 (350) F-probability = .0311

Prog.	Mean	95% Conf.	N
NuclE+	2.91	± 0.61	(23)
MSE+	2.92	0.43	(24)
CivilE	2.97	± 0.20	(72)
*XsferE	3.05		(22)
ChemE	3.06	± 0.27	(34)
EECS	3.13	0.24	(74)
MechE	3.40	± 0.21	(84)
IEOR	3.58	0.32	(19)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

In Civil Engineering, a related proposition was posed, asserting that the Department does not seem to recruit faculty with enough experience in the practice of professional engineering [CEQ #4]. A majority of the C.E. respondents disagreed (S.D. 12-44/30/14-0% S.A.).

In Materials Science and Engineering, the 12 double major respondents tended to disagree (S.D. 0-42/50/8-0% S.A.) that their programs were such that one was too theoretical, the other too applied [MSEQ #4C].

Methodology Courses and Labs. Overall, a plurality of the respondents disagreed (S.D. 7-36/29/22-5% S.A.) with the proposition that their program's methodology, lab or technical courses do not provide enough experience in real problem-solving and analysis [UMPEQ #50]. But there were statistically significant differences between the average ratings for some of the programs [F-prob.= .0002]. A majority agreed that the courses or problems were not sufficiently realistic in IEOR (5-19/24/43-10) and a plurality agreed in Mechanical Engineering (3-27/27/29-14). These ratings tended to be significantly worse than those where a large majority, majority, or a strong plurality disagreed, as in Geology (8-62/19/12-0), Physics (17-43/29/6-6), Chemistry (15-42/18/24-0), Chemical Engineering (8-44/22/24-2) and L&S Computer Science (9-38/32/15-6). Where responses were fairly evenly divided as to whether the methodology or lab courses provide enough experience in real problem-solving and analysis, as in EECS (4-28/35/29-3) and Materials Science (0-30/48/17-4), the mean ratings tended also to be lower than those in Geology and Physics.

Item: The program's methodology, lab, or technical courses do not provide the student with enough experience in real problem-solving and analysis. [UMPEQ Q50]. [1977 wording: ~~lab~~.]

TOTALS — Engineering and Physical Sciences

7% Str. Disagree, 36% Disagree, 29% In Between, 5% Str. Agree, 22% Agree

Mean: 2.82 ± 0.09 (503) F-probability = .0002

Prog.	Mean	95% Conf.	N
Geol	2.35	± 0.32	(26)
Physic	2.40	0.36	(33)
*XsfLSC	2.45	0.51	(20)
Chem	2.52	0.37	(33)
ChemE	2.66	± 0.26	(39)
*HltS77	2.68	0.10	(389)
LSComp	2.70	0.28	(33)
CivilE	2.79	0.24	(72)
Math	2.82	± 0.38	(17)**
NuclE+	2.83	0.45	(23)
*SocS79	2.94	0.12	(349)**
MSE+	2.96	0.36	(23)
EECS	2.99	± 0.23	(68)
*XsferE	3.00	0.45	(22)
*SHum77	3.01	0.20	(130)**
MechE	3.23	0.25	(73)
IEOR	3.33	0.48	(21)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

In Chemical Engineering, apropos of two courses, Chem Engineering 150 (Fluid Flow and Heat Transfer) and Chem Engineering 153 (Mass Transfer), a very large majority of the majors responding agreed (S.D. 4-12/14/52-19% S.A.) that laboratory exposure to fluid flow, heat transfer, mass transfer, and measurement techniques should accompany the lectures [ChEQ #14].

A large majority of the entire group of respondents disagreed (S.D. 10-54/25/10-1% S.A.) that their methodology, lab or technical courses overemphasize traditional methods and values or are not up-to-date [UMPEQ #51]. A majority or more disagreed in almost every program, but ratings in Nuclear Engineering (4-48/26/17-4), IEOR (5-53/21/11-11) and Chemical Engineering (6-43/38/11-2) tended to be lower than those where disagreement was almost overwhelming, such as in Geology (17-65/13/4-0) and L&S Computer Science (14-64/18/4-0) [F-prob.= .0180].

Item: The program's methodology, lab, or technical courses overemphasize traditional methodology and values or are not up-to-date. [UMPEQ Q51]. [1977 wording: ~~lab~~.]

TOTALS — Engineering and Physical Sciences

10% Str. Disagree, 54% Disagree, 25% In Between, 1% Str. Agree, 10% Agree

Mean: 2.39 ± 0.08 (472) F-probability = .0180

Prog.	Mean	95% Conf.	N
Geol	2.04	± 0.31	(23)
LSComp	2.12	0.20	(30)
*HltS77	2.15	0.09	(381)
Math	2.20	0.47	(15)**
Physic	2.21	± 0.32	(33)
CivilE	2.28	0.18	(67)
Chem	2.39	0.32	(33)
*XsfLSC	2.45	0.39	(20)
EECS	2.45	± 0.18	(66)
MechE	2.45	0.21	(66)
*SocS79	2.50	0.11	(348)**
MSE+	2.50	0.35	(24)
ChemE	2.60	± 0.23	(53)
IEOR	2.68	0.53	(19)
NuclE+	2.70	0.42	(23)
*XsferE	2.71	0.44	(17)
*SHum77	2.98	0.20	(164)**

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Equipment. Across the 12 Engineering and Physical Science programs, there was a "very substantial" spread in the respondents' ratings of whether there was "a shortage of adequate equipment, computer facilities, supplies, or media materials" for use by students in the program [UMPEQ #49: F-prob.= .0000]. Overall, opinion was divided nearly evenly (S.D. 8-31/20/23-19% S.A.). The responses ranged from large majority disagreement in Geology (25-42/25/8-0% S.A.) to agreement by an overwhelming majority in L&S Computer Science (6-0/6/30-58) and by a large majority in EECS (1-15/18/24-42). Agreement that equipment was in short supply was by majority or plurality in Materials Science (4-17/26/43-9), Chemical Engineering (12-21/22/24-21) and Nuclear Engineering (9-30/13/39-9). With only a plurality disagreeing, there may also be some equipment shortages in Chemistry (14-31/22/22-11) and Mechanical Engineering (8-36/30/20-7). The second and third-best ratings of the availability of adequate equipment (with large majorities disagreeing) were observed in Civil Engineering (7-55/18/15-4) and Physics (6-61/12/15-6). The spread of these ratings is so great that the means for programs where pluralities agreed or disagreed (i.e., the middle-rated programs) were significantly better (less short of equipment) than those in L&S Computer Science and EECS, but also tended to be significantly worse than in Geology.

These results certainly seem to provide strong evidence of the need for the full award by the State of the University's requests for monies for the instructional use of computers, and for additional support by Systemwide Administration of computer-related needs on the Berkeley campus.

Item: There is a shortage of adequate equipment, computer facilities, supplies, or media materials for use by students in this program. [UMPEQ Q49.] [1977 wording: computer facilities. . . .; 1979 wording: adequate.]

TOTALS — Engineering and Physical Sciences

8% Str. Disagree 19% Str. Agree
31% Disagree 20% In Between 23% Agree

Mean: 3.13 ± 0.11 (308) F-probability = .0000

Prog.	Mean	95% Conf.	N
Geol	2.17	± 0.39	(24)
Physic	2.53	0.37	(33)
CivilE	2.53	0.23	(71)
*MltS77	2.59	0.11	(370)
IEOR	2.68	± 0.51	(19)
*SocS79	2.79	0.13	(277)**
MechE	2.82	0.24	(76)
Math	2.83	0.52	(18)**
Chem	2.86	± 0.42	(36)
*SHum77	3.00	0.17	(196)**
NuclE+	3.09	0.52	(23)
ChemE	3.21	0.35	(58)
*XsferE	3.22	± 0.38	(18)
*XsfLSC	3.33	0.56	(21)
MSE+	3.35	0.44	(23)
EECS	3.91	0.27	(74)
LSComp	4.36	0.28	(53)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Technical Writing Courses. The status and need for "technical writing courses," sometimes with oral presentation components, were a subject of interest in several of the individual department supplementary questionnaires.

In Civil Engineering, a large majority of the respondent majors agreed (S.D. 5-12/17/27-39% S.A.) that Civil Engineering 190 (technical writing course) should be made a required course for all C.E. majors [CEQ #2]. A majority also agreed (9-17/18/47-19) that there should be a significant oral component of the technical writing course [CEQ #3].

In Materials Science & Engineering, agreement was overwhelming (S.D. 0-5/5/50-40% S.A.) that a technical writing course should be required of all majors and double majors in MSE [MSEQ #3].

In Mechanical Engineering, with 60% responding (some nonrespondents surely not knowing enough about the M.E. 107B course currently to venture an answer), a narrow plurality agreed (S.D. 18-18/20/26-20% S.A.) that Mechanical Engineering 107B (Mechanical Engineering Phenomena Lab) should be replaced by a technical writing course--"report writing and research techniques" [MEQ #1].

In Chemical Engineering, a majority agreed (S.D. 4-23/19/16-39% S.A.) that a technical writing course should be required of all Chemical Engineering majors [ChEQ #12]. A majority of the respondents also agreed (18-13/7/31-26) that if only some Chem Engineering majors are required to take a technical writing course ("while others pass a test"), those taking the course should be able to count it as one of their technical electives [ChEQ #10]. And a large majority agreed (9-13/13/40-24) that because Chem Engineering 151 (Chemical Engineering Lab) requires an oral presentation, there should be an oral component of the Department's technical writing course [ChEQ #11].

Of the majors who presumably had not yet taken Chem Engineering 151A (54% of the total possible respondents in Chem E.), an overwhelming 91% agreed (with 50% strongly so), that they were fully aware they would be required to pass an expository writing exam or the technical writing course before enrolling in Chem Engineering 151A [ChEQ #9]. Three students (9% of those not yet to 151A) disagreed strongly--apparently unaware entirely of the requirement. An overwhelming majority of all of the Chemical Engineering respondents agreed (2-2/7/32-57) that the Department should finalize its policies about Chem Engineering 195 (the technical writing course) and put the information in the College's Announcement [ChEQ #13].

Of the 28 or so students (47% of the respondents) who presumably had completed all or portions of Chem Engineering 151A-B, however, a very large majority agreed (S.D. 4-11/14/46-25% S.A.) that it adequately prepared/prepares them for writing reports in a professional capacity [ChEQ #8].

Interest and Challenge of Coursework. One normally expects the coursework in the student's chosen area of specialization to be interesting and the as-yet-unattained comprehension in-depth to provide a challenge. Indeed, when asked whether the coursework in their program is "interesting and challenging," a very large majority of the respondents agreed (S.D. 1-4/22/55-19% S.A.) [UMPEQ #44]. Still, agreement tended to be significantly higher where it was overwhelming, as in Physics (0-3/8/58-33), Geology (0-4/15/42-38), L&S Computer Science (0-4/9/58-28) and Nuclear Engineering (0-4/13/54-29) than where it was by large majority, as in IEOR (0-10/24/67-0) and Mechanical Engineering (3-6/26/50-15) [F-prob.= .0026].

Item: The coursework in this program is interesting and challenging. [UMPEQ Q44].

TOTALS — Engineering and Physical Sciences

1% Str. Disagree, 4% Disagree, 22% In Between, 19% Str. Agree, 55% Agree

Mean: 3.87 ± 0.07 (538) F-probability = .0026

Prog.	Mean	95% Conf.	N								
IEOR	3.37	± 0.31	(21)	*SocS79	3.78	± 0.38	(484)	ChemE	3.90	± 0.19	(60)
MechE	3.67	0.20	(86)	EECS	3.81	0.19	(73)	Chem	3.92	0.25	(37)
Math	3.76	0.27	(37)	MSE+	3.84	0.25	(25)	*XsfLSC	3.96	0.33	(23)
CivilE	3.78	0.15	(76)	*XsferE	3.86	0.31	(22)	NuclE+	4.08	0.33	(24)

LSComp	4.11	± 0.20	(53)
Geol	4.15	0.34	(26)
Physic	4.20	0.22	(40)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Summary of Problems by Program: Coverage of Content

This section dealt with the adequacy of the coverage of content, including: the availability of advanced courses; the representation in coursework of alternative schools of thought; fieldwork, methodology and lab courses; equipment; and in the engineering departments, with the emphasis on theory. In addition, the general interest and challenge of the coursework was of concern.

LSComp EECS

In L&S Computer Science and EECS, the most prominent problem was the shortage of equipment and/or computer facilities, which was rated as acute. For a large minority of L&S Computer Science students, advanced coursework was not available in all areas of interest. In EECS, theory in most courses was perhaps somewhat overemphasized, and methods courses may be in need of more emphasis on real problem-solving and analysis. In addition (with 57% of the EECS sample responding), coursework with coverage of nondominant schools of thought (environmentalist, low-technology, etc.) was thought to be in too short supply.

MechE CivilE Chem

In Mechanical Engineering, Civil Engineering and Chemistry (with 60, 68, and 57% responding, respectively), course coverage of nondominant schools of thought (environmentalist, low-technology, etc.) was rated as inadequate. In Mechanical Engineering, theory was rated as somewhat overemphasized in most classes and methods courses/labs as not providing enough experience in real problem-solving and analysis. *Many Mechanical Engineering students wanted M.E. 107B to be a technical writing course, and a large majority of Civil Engineering respondents thought that a technical writing course should be required of all majors and have an oral component.*

ChemE MSE+ NuclE+

In Chemical Engineering, Materials Science and Nuclear Engineering (with 74, 68, and 54% responding, respectively), course coverage of nondominant schools of thought (environmentalist, low-technology, etc.) was not regarded as sufficient. The availability of advanced courses in all of the students' areas of interest was not satisfactory to a large minority of students in Materials Science (nor to a smaller minority in Chemical Engineering). Materials Science students also were not very

satisfied with the extent of their methods-related (lab) experience involving real problem-solving and analysis. *In Materials Science (especially) and Chemical Engineering, a required technical writing course was deemed appropriate.*

IEOR — In IEOR, theory in most courses was seen as overemphasized; methodology courses were rated as providing insufficient experience in real problem-solving and analysis and also as overemphasizing traditional methods and values, or as not being up-to-date. The availability of courses which explore the contributions of nondominant schools of thought was rated as so-so.

Physic — In Physics (with 65% responding), course coverage of nondominant schools of thought was not regarded as sufficient.

COURSE EVALUATIONS IN THE ENGINEERING DEPARTMENTS

In the engineering departments (only), students were asked to assess the effectiveness of their required lower division coursework in Chemistry, Physics, Math and Engineering. In addition, respondents in Civil Engineering, Mechanical Engineering, Materials Science, and Chemical Engineering rated their satisfaction with, and the applicability or relevance to their areas of interest, of all of the required upper division courses for their program.

Crossreferences. For a number of the engineering departments, especially the four departments named above, there are various ratings presented in the two previous sections on Curricular Structure and Coverage of Content which also are related, at least tangentially, to the more direct evaluations of courses contained in this section.

Required "Service" Courses

Since some students would have taken the (mostly) lower division coursework for which ratings are reported in this subsection at other institutions, only 57-78% of the total number of respondents answered the five questions about such coursework at Berkeley.

Coursework and Labs in Chemistry. Only a rather modest plurality of the 63% of the Engineering Sample who responded agreed (S.D. 12-21/21/34-12% S.A.)* that for their needs, the laboratory portions of UCB Chemistry courses provided an effective learning experience [ESO #9]. The mean ratings by department were not entirely uniform [F-prob.= .0033]. A large majority of the Chemical Engineering majors agreed (8-10/21/44-17) that their Chem labs provided effective learning experiences, and so did a majority of Civil (7-16/19/49-9) and Nuclear Engineering (7-14/29/36-14) students. These ratings tended to be higher than those given by Mechanical Engineering students, among whom disagreement prevailed by a majority (26-28/19/17-11).

Item: For my needs, the laboratory portions of UCB Department of Chemistry Courses provided an effective learning experience. [ES Q9].

TOTALS — Engineering

12% Str. Disagree, 21% Disagree, 21% In Between, 34% Agree, 12% Str. Agree

*Mean: 3.13 ± 0.16 (229)** F-probability = .0033*

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
*XaferE	2.38	*	(12)**	SECS	2.86	± 0.37	(42)**	IEOR	3.20	± 0.48	(13)**	CivilE	3.37	± 0.34	(43)**
MechE	2.60	0.39	(47)**	MSE+	3.19	0.76	(16)**	NuclE+	3.36	0.66	(14)**	ChemE	3.34	0.31	(32)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

See "" on following page.

As regards the instruction and content in Chemistry 1A-B/4A-B, again only a modest plurality agreed (S.D. 11-16/29/36-9% S.A.)* that they were effective [ESQ #10]. There were no statistically significant differences between the ratings by the seven groups of majors [F-prob.= .2036], but the confidence intervals for two of the groups overlapped only barely. Chemical Engineering majors seemed most likely to agree (3-9/27/48-12) on the effectiveness of the instruction and content in Chem 1/4A-B, and Mechanical Engineering students seemed least likely (17-19/33/21-10).

Item: For my needs, the Chemistry Department at UCB provided effective instruction and content in courses 1A-B/4A-B. [ES Q10].

TOTALS — Engineering

11% Str. Disagree, 16% Disagree, 29% In Between, 9% Str. Agree, 36% Agree

*Mean: 3.16 ± 0.19 (207)** F-probability = .2036*

Prog.	Mean	95% Conf.	N								
MechE	2.90	± 0.36	(48)**	EECS	3.03	± 0.39	(38)**	CivilE	3.17	± 0.35	(42)**
*NaveE	2.92		(13)**	MSE+	3.06	0.64	(16)**	NuclE+	3.33	0.62	(15)**
IEOR	3.33	± 0.43	(15)**	ChemE	3.58	0.33	(33)**				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

In Chemical Engineering, a very large majority of the respondents also agreed (S.D. 9-13/9/50-20% S.A.) that Chem 14 (Chemical Thermodynamics) adequately prepared them for Chem Engineering 141A (Chemical Engineering Thermodynamics) [ChEQ #2].

Coursework in Physics. Courses required from UCB's Physics Department met with majority agreement (S.D. 5-12/25/46-11% S.A.) that instruction and content were effective for the students' needs [ESQ #11]. There were no statistically significant differences between departmental ratings [F-prob.= .1910], but the highest level of satisfaction seemed to prevail in Materials Science (5-5/14/57-19) whereas agreement was only by plurality in Civil Engineering (12-8/38/38-4).

Item: For my needs, the Physics Department at UCB provided effective instruction and content in the courses required for my program. [ES Q11].

TOTALS — Engineering

3% Str. Disagree, 12% Disagree, 25% In Between, 11% Str. Agree, 46% Agree

*Mean: 3.46 ± 0.12 (272)** F-probability = .1910*

Prog.	Mean	95% Conf.	N								
CivilE	3.13	± 0.29	(32)**	MechE	3.45	± 0.23	(60)**	NuclE+	3.58	± 0.52	(19)
ChemE	3.41	0.28	(46)	*NaveE	3.46		(13)**	EECS	3.58	0.26	(37)
IEOR	3.59	± 0.41	(17)	MSE+	3.81	0.45	(21)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Coursework in Mathematics. Required courses taken from UCB's Math Department were rated slightly better yet, and more uniformly so [ESQ #12; F-prob.= .4819]. A large majority agreed (S.D. 4-14/18/51-13% S.A.) that, for their needs, instruction and content were effective.

Item: For my needs, the Mathematics Department at UCB provided effective instruction and content in the courses required for my program. [ES Q12].

TOTALS — Engineering

4% Str. Disagree, 14% Disagree, 18% In Between, 13% Str. Agree, 51% Agree

*Mean: 3.36 ± 0.12 (266)** F-probability = .4819*

Prog.	Mean	95% Conf.	N								
MSE+	3.23	± 0.45	(22)	NuclE+	3.53	± 0.52	(19)	CivilE	3.60	± 0.33	(33)**
ChemE	3.38	0.34	(37)**	MechE	3.39	0.29	(59)**	*NaveE	3.62		(13)**
IEOR	3.69	± 0.30	(16)	EECS	3.72	0.25	(60)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Lower Division Coursework in Engineering. A large majority of the respondents also agreed (S.D. 0-9/23/52-15% S.A.) that the lower division courses required

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

to be taken from the Engineering Department provided effective instruction and content for their needs [ESO #13], again with no differences between the departmental ratings [F-prob.= .6841].

Item: For my needs, the Engineering Department at VCS provided effective instruction and content in the lower division courses required for my program. [ES Q13].

Prog.	Mean	95% Conf.	N
ChemE	3.30	± 0.30	(36)**
*XtfarE	3.36		(14)**
IEOR	3.65	± 0.36	(17)
MechE	3.74	0.21	(63)
CivilE	3.75	± 0.21	(60)
EECS	3.77	0.24	(64)
MSE+	3.86	± 0.33	(22)
NuclE+	3.86	0.30	(22)

TOTALS -- Engineering

0% Str. Disagree 9% Disagree 23% In Between 32% Agree 13% Str. Agree

Mean: 3.73 ± 0.10 (284) F-probability = .6841

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Courses in the Major Department

For four programs in engineering--Civil, Mechanical, Materials Science and Chemical--the ARU's Engineers Joint Council-sponsored evaluation included student assessments of their required upper division coursework (and a few other courses). Questions asked for students' ratings of their overall satisfaction with each course, its applicability or relevance to their areas of interest, and of the appropriate number of units. Data from the first two of these three ratings are summarized below. The question on unit values is treated in the section on "Student Workload" (pages 47-48). The full results from which these summaries are derived are presented in Appendix B.

Student Ratings of Overall Satisfaction with, and Applicability/Relevance of, Upper Division Courses in Their Major, in Cumulative Percentages*

Category Ranges of Mean Course Ratings (and GPA Equivalents)*	Overall Satisfaction* Program (& No. of Courses) C.E. (15)	M.E. (15)	MSE+ (12)*	ChemE (17)[a]	Applicability or Relevance* Program (& No. of Courses) C.E. (15)	M.E. (15)	MSE+ (12)*	ChemE (17)[a]
4.30- 5.00 (B+ to A)	0%	0%	*8%	12%	0%	0%	*8%	*24%
4.00- 4.29 (B to B+)	0	7	8	24	13	13	8	*59
3.70- 3.99 (B- to B)	27	7	8	24	47	*27	*50	71
3.30- 3.69 (C+ to C++)	53	*67	*42	*65	67	*80	67	71
3.00- 3.29 (C to C+)	73	*93	58	**88	67	*100	83	*76
2.70- 2.99 (C- to C)	*93	100	67	*94	73	100	92	*88
1.00- 2.69 (F to D++)	100	100	*100	*100	*100	100	*100	*100

*The original rating scale, upon which the category ranges are based, is: 1= Very Low; 2= Low; 3= In Between; 4= High; 5= Very High. The number of asterisks affixed to percentage figures in the table indicates the number of rated courses that are offered by departments other than that in which the respondent is majoring (see also footnote "a"). Percentages are calculated for all courses evaluated in the questionnaires, except if there were six or fewer raters. Of 47 C.E., M.E. and Chem. E. courses, only two had 12 or fewer raters.

[a]The 17 course ratings by Chemical Engineering students include separate entries for Chemistry 111A (new), Chemistry 111A and 111B (both old), and two for the student's introductory course in computer science, one if the course was self-paced, the other if not. (The introductory computer science course could have been in either upper or lower division.)

Summary of Evaluation of Upper Division Courses in the Major. In summary of the foregoing table, the following statements can be made about the four programs:

1) *Students' ratings of "overall satisfaction" with courses required by the major, and with the "applicability or relevance" to the students' areas of interest, were highest among Chemical Engineering majors in assessing Chemical Engineering Department courses (but Department of Chemistry courses were not well-rated by Chemical Engineering students in either regard).*

2) *Students' ratings of their "overall satisfaction" with Mechanical Engineering courses were almost all "so-so" (87% falling between 3.00 and 3.69). While M.E. courses were more uniformly applicable or relevant to students' interest areas, there were also fewer courses that received highly positive ratings.*

3) *Ratings of "overall satisfaction" with required courses were lowest among the Materials Science majors and double majors.*

4) *There was considerable diversity of opinion about the applicability or relevance to the students' interest areas of the various courses in Civil Engineering, with 47% of the courses receiving fairly high ratings (3.70 and higher) and 27% receiving low ratings (2.69 or lower).*

Summary of Problems by Program: Course Evaluations in the Engineering Departments

This section dealt with engineering students' evaluations of their required coursework in the UCB departments of Chemistry, Physics, Math and (lower division) Engineering. For individual upper division courses in Civil Engineering, Mechanical Engineering, Materials Science and Chemical Engineering, it also summarized the respondents' ratings of overall satisfaction, of the applicability or relevance of the courses to their areas of interest. Portions of this summary draw directly on the survey results presented in Appendix B (i.e., include some material not otherwise cited in the text).

Only a plurality of the engineering respondents, and a narrow plurality when only College of Engineering students are considered, regarded the laboratory portions of Department of Chemistry courses as providing effective learning experiences. Roughly the same proportional views prevailed in the evaluation of Chemistry 1A-B/4A-B. Ratings of required courses in Physics and Math were more positive, though there may well remain some room for improvement from the perspective of engineering students. Although Chemical Engineering majors gave higher ratings than the other engineering students to Department of Chemistry labs and Chem 1A-B/4A-B, *the Chemical Engineering students' ratings of Chem 110A, the value of which was questioned as a requirement (see page 4), were low as regards satisfaction and applicability/relevance (especially). Chem 110C and Chem 111A (and the prior Chem 111A and Chem 111B) received mediocre ratings as regards the overall satisfaction, and applicability or relevance to the interest areas, of Chemical Engineering majors.* (Chem) (Physic) (Math) ChemE

The Materials Science majors and double majors gave low or mediocre ratings on overall satisfaction to MSE 101, 102, 103L, 108 (especially), 121, 121L (especially) and possibly 142, and also to EECS 109 (especially). Materials Science students gave weak ratings of applicability/relevance to MSE 102, 103L, 121L and possibly 142, and also to EECS 109. Judging by the differentials between ratings, MSE 101 and 108 seem to have much greater potential than is currently realized. MSE+ (EECS)

MechE (EECS) *Mechanical Engineering majors expressed (only) middle-level satisfaction with many of their upper division courses, and gave few truly high or low ratings. The majors gave mediocre ratings of overall satisfaction to M.E. 104B, 105A, 108, and 107A, 107B and 107C, as well as to EECS 100A and EECS 100B. Applicability or relevance was also rated somewhat weak in M.E. 104B and 107A, and in EECS 100A and 100B.*

CivilE (MechE) *Civil Engineering majors' ratings of overall satisfaction and applicability/relevance (especially) of their courses were rather bimodal. Low to mediocre ratings of overall satisfaction were given to C.E. 165A and 165B, 110, 140, 170 (especially) and 141, and also to M.E. 104A. Ratings indicative of low applicability or relevance to the students' interest areas were given to C.E. 165A (and not 165B), 140, 170 and 141, as well as to M.E. 104A.*

TEACHING AND FACULTY-STUDENT INTERACTION OUTSIDE THE CLASSROOM

Crossreferences

While the entire program is in most respects a faculty responsibility, a few other sections of this text present findings fairly closely related to the teaching dimension. In addition to the preceding section on "Curriculum," for example, there is a six-part "Overview of Department/Program Contributions" to students' educational goals (pages 79-88). The reader may also wish to compare the overall influence of the entire instructional process with a number of other prospective "Influences on Students' Overall Growth and Learning" (pages 76-79). The extent to which students expect to remember what they have learned is treated on page 57. Finally, certain elements of advising are discussed in the section, "Provision of Information to Students" (pages 60-68). There is also the matter of "Competition, Testing, Grading and GPA" (pages 34-42).

ELEMENTS OF TEACHING

Because the Academic Review Unit does not want to duplicate the various campus energies devoted to teaching evaluation, the Undergraduate Major Program Evaluation Questionnaire (UMPEQ) includes only a few key items related directly to teaching. The primary areas of concern here are focused on the adequacy of faculty feedback on students' work; the availability and accessibility of supplemental instruction or assistance; the adequacy of the treatment of social issues related to the discipline or profession; and, more generally, on the challenge, quality, and motivational impact of the teaching as a whole. In addition, this section focuses on the knowledge and preparation, and teaching effectiveness of Teaching Assistants (T.A.s) and, in the engineering departments, on the extent to which the majors have encountered language barriers with T.A.s. Subsequent subsections deal with "Faculty-Student Contact" and "Faculty Receptivity to Students."

Feedback on Students' Work. The adequacy of feedback to students on their work is a critical element in the teaching-learning process. Overall, the respondents were nearly equally divided, with few agreeing strongly (S.D. 10-25/29/32-4% S.A.)* as to whether comments on or review of students' work by professors and teaching assistants are usually thorough enough [UMPEO #25]. (Student work includes midterms, papers, problem sets, experiments and class performance.) Most of the program ratings were also rather evenly divided, with only one department receiving a good rating on this crucial aspect of teaching. Geology majors were more likely than students in seven other programs to agree (4-4/27/46-19) that comments on their work are usually thorough enough [F-prob.= .0012]. On the other hand, pluralities disagreed in EECS (18-30/28/22-3), Materials Science (13-33/29/21-4), Mechanical Engineering (13-30/24/31-2), Nuclear Engineering (8-33/21/38-0) and Civil Engineering (12-24/30/30-4). EECS was also rated significantly lower in adequacy of faculty and teaching assistant feedback to students than was Physics, where a slim majority agreed (8-15/25/48-5).

Item: Comments or review provided by faculty, T.A.s and readers on my midterms, papers, problem sets, experiments and class performance are usually thorough enough. [UMPEO Q25].

TOTALS — Engineering and Physical Sciences

10% Str. Disagree, 25% Disagree, 29% In Between, 4% Str. Agree, 32% Agree

Mean: 2.96 ± 0.09 (562) F-probability = .0012

Prog.	Mean	95% Conf.	N
EECS	2.62	± 0.25	(74)
MSE+	2.71	0.46	(24)
MechE	2.80	0.23	(87)
*XsferE	2.82	0.54	(22)
*XsfLSC	2.88	± 0.42	(24)
NuclE+	2.88	0.44	(24)
CivilE	2.91	0.25	(76)
LSComp	3.00	0.25	(54)
ChemE	3.02	± 0.25	(62)
Math	3.05	0.33	(37)
*Socs79	3.09	0.10	(488)
Chem	3.11	0.38	(37)
*Hlts77	3.15	± 0.10	(417)
IEOR	3.19	0.43	(21)
Physic	3.25	0.33	(40)
*SHum77	3.46	0.13	(269)
Geol	3.73	0.39	(26)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Further Explanation or Referral for Help. When further explanation or extra instruction is needed in coursework for the major, it is important for the student to be able to get it. Consequently, the UMPEO asked whether help or a referral for further explanation or instruction seemed difficult to obtain [UMPEO #32]. Only a plurality of the respondents disagreed (S.D. 9-33/33/20-5% S.A.) that help or a referral did not seem easy to obtain. This response seems particularly weak in that the average ratings in all three of the other samples (Health-related Sciences, Selected Humanities, Social Sciences) were better than those found in any of the Engineering and Physical Sciences programs. Moreover, the percentage of applicable responses was higher among engineering and physical sciences students (84.4%) than in any of the other three samples. In the Engineering and Physical Sciences Sample, the responses by program were fairly uniform [F-prob.= .7327], with agreement that help or a referral is difficult to obtain in only one instance falling below 22%, and then only in a unique fashion: S.D. 10-20/55/10-5% S.A. (in IEOR).

Item: I have needed further explanation or extra instruction in courses in my major, but help or a referral did not seem easy to obtain. [UMPEO Q32].

TOTALS — Engineering and Physical Sciences

9% Str. Disagree, 33% Disagree, 33% In Between, 5% Str. Agree, 20% Agree

Mean: 2.80 ± 0.09 (477) F-probability = .7327

Prog.	Mean	95% Conf.	N
*Hlts77	2.44	± 0.12	(345)
*SHum77	2.55	0.15	(203)**
*Socs79	2.55	0.11	(368)**
Chem	2.59	0.42	(32)
Physic	2.60	± 0.41	(30)**
Geol	2.65	0.32	(23)
Math	2.67	0.44	(27)**
MSE+	2.71	0.38	(24)
NuclE+	2.73	± 0.44	(22)
ChemE	2.78	0.27	(54)
IEOR	2.80	0.43	(20)
MechE	2.83	0.23	(75)
CivilE	2.85	± 0.25	(63)
EECS	3.00	0.26	(61)
LSComp	3.00	0.32	(44)
*XsfLSC	3.13	0.44	(20)
*XsferE	3.33	0.34	(18)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

*The figures in parentheses represent the percentages of respondents choosing each of the first five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Social Issues. Although the proportion of respondents who answered the item was somewhat low in several non-engineering programs (and 75.4% overall), in no case did as much as a majority of the respondents agree that faculty in their program show enough concern about social issues in teaching their subjects [UMPEO #33]. There were no differences by program [F-prob.= .3881]. Overall, disagreement that faculty show enough concern about social issues in their teaching prevailed by a narrow plurality (S.D. 11-23/38/24-4% S.A.) and strong agreement was relatively rare. The mean response for every Engineering and Physical Science program was lower than observed for the whole of the Social Science (especially) and Health-related Science Samples, and in only two cases exceeded the average for the Selected Humanities.

Item: Faculty in this program show enough concern about social issues in teaching their subjects. [UMPEO Q33].

TOTALS — Engineering and Physical Sciences

11% Str. Disagree, 23% Disagree, 38% In Between, 24% Agree, 4% Str. Agree

Mean: 2.88 ± 0.10 (426) F-probability = .3881

Prog.	Mean	95% Conf.	N		Mean	95% Conf.	N		Mean	95% Conf.	N
Math	2.50	± 0.79	(12)**	MechE	2.87	± 0.22	(73)	*XsfLSC	3.00	± 0.48	(20)
ChemE	2.59	0.27	(34)	EECS	2.87	0.28	(61)	*XsferE	3.00	0.48	(17)
LSComp	2.72	0.36	(32)**	MSE+	2.95	0.41	(19)	Geol	3.00	0.33	(20)
IEOR	2.32	0.49	(17)	Chem	2.96	0.42	(25)**	CivilE	3.01	0.25	(68)
*Hum77	3.33	± 0.13	(198)**								
NuclE+	3.14	0.44	(21)								
Physic	3.18	0.54	(22)**								
*Hlc577	3.30	0.12	(320)**								
*Soc579	3.71	0.10	(455)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

In the engineering departments, the students were also asked whether they would like the faculty to put more emphasis on the "social responsibilities and ethics related to the profession and its practice (e.g., including the impact of technology and practice on environment, social structure, individuals)" [ESQ #17]. Overall, a sizable plurality agreed (S.D. 6-19/27/32-15% S.A.), but there were differences between some of the program ratings [F-prob.= .0122]. Agreement that faculty should put more emphasis on the social responsibilities and ethics in the profession tended to be significantly higher in IEOR (0-20/5/70-5) and Civil Engineering (0-17/23/47-13) than in Nuclear Engineering (20-30/20/15-15) and EECS (11-21/35/21-13). Agreement also prevailed by a narrow majority in Mechanical Engineering (5-20/23/28-23) and Chemical Engineering (6-15/28/34-17).

Item: I would like the faculty to put more emphasis on the social responsibilities and ethics related to the profession and its practice (e.g., including the impact of technology and practice on environment, social structure, individuals). [ES Q17].

TOTALS — Engineering and

6% Str. Disagree, 19% Disagree, 27% In Between, 32% Agree, 15% Str. Agree

Mean: 3.33 ± 0.12 (338) F-probability = .0122

Prog.	Mean	95% Conf.	N		Mean	95% Conf.	N		Mean	95% Conf.	N
NuclE+	2.75	± 0.64	(20)	MSE+	3.27	± 0.37	(22)	ChemE	3.42	± 0.31	(33)
EECS	3.03	0.28	(72)	*XsferE	3.40		(20)	MechE	3.46	0.25	(81)
CivilE	3.56	± 0.22	(70)								
IEOR	3.60	0.41	(20)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

The weaknesses suggested by the majors' responses to the two preceding items seem confirmed, to roughly the same extent, by the answers to questions about the adequacy of coverage in the coursework of nondominant schools of thought (page 9) and about their program's contribution to "promoting social responsibility or developing skills useful in the community" (page 82).

Challenge, Quality, and Motivational Impact of Teaching. Overall, a majority of the respondents agreed (S.D. 3-7/30/42-17% S.A.) with the UMPEO's broadest item on teaching--that teaching by faculty in their program was "challenging, of high quality, and increases my interest in the subject matter" [UMPEO #36]. For the two programs where agreement was only by a plurality, namely IEOR (15-5/35/35-10) and Math (8-16/32/29-14), ratings tended to be significantly lower than in Geology, where agreement was by overwhelming majority (0-12/8/36-44) [F-prob.= .0200].

Item: Teaching by faculty in this program is challenging, of high quality, and increases my interest in the subject matter. [UMPEQ Q36].

Prog.	Mean	95% Conf.	N							
IEOR	3.20	± 0.36	(20)	MSE+	3.36	± 0.29	(25)	EECS	3.66	± 0.21 (74)
Math	3.24	0.38	(37)	MechE	3.37	0.20	(84)	CivilE	3.73	0.22 (73)
ChemE	3.48	0.28	(60)	LSComp	3.62	0.22	(53)	NuclE+	3.74	0.37 (23)
*XsferE	3.55	0.61	(22)	*Socs79	3.64	0.09	(489)	Physic	3.83	0.31 (40)

Chem	3.83	± 0.29 (35)
*XsfLSC	4.00	0.41 (24)
Geol	4.12	0.42 (25)

TOTALS -- Engineering and Physical Sciences

3% Str. Disagree, 7% Disagree, 30% In Between, 17% Str. Agree, 42% Agree

Mean: 3.63 ± 0.08 (549) F-probability = .0200

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Research Vs. Teaching in Civil Engineering. A majority of the Civil Engineering respondents agreed (S.D. 2-17/31/37-14% S.A.) that the Department seems to put too much emphasis on research and not enough on the teaching ability of faculty [CEQ #5].

Guest Lectures by MSE Faculty in Other Departments' Courses. Among the 11 double majors responding to an item on whether the content in their other major could be taught more effectively if Materials Science faculty were used as guest lecturers, opinion was evenly divided (S.D. 9-27/27/27-9% S.A.) [MSEQ #4D].

Teaching Assistants (T.A.s)

Knowledge and Preparation of T.A.s. The two principal elements necessary for teaching, subject matter knowledge and teaching skills, were each the subject of items about teaching assistants. Both items inquired about lower as well as upper division T.A.s. The first item asked what percentage of T.A.s in the student's program: "Are knowledgeable and well-prepared in the material being taught?" [UMPEQ #37A].

The scale used in response was: 1= 0-20%; 2= 21-40%, 3= 41-60%; 4= 61-80%: and 5= 81-100%. If we treat the midpoint of each category range as the average response of the students choosing that category (e.g., 21-40% category = 30%), the average response across the 12 Engineering and Physical Science programs indicates that:

1) 65.5% of the T.A.s were knowledgeable and well-prepared.

For the individual programs, the percentage of T.A.s who were rated as knowledgeable and well-prepared ranged from lows of 57% in IEOR and EECS to highs of 78% in Geology and 77% in Physics. In all, Geology and Physics tended to be significantly higher than six or seven programs. Chemistry, where 71% of the T.A.s were rated as knowledgeable/well-prepared, also tended to be rated higher than IEOR and EECS [F-prob.= .0002]. In the original metric, only a plurality of the respondents in IEOR and EECS agreed that 60% or more of their T.A.s had been knowledgeable and well-prepared, whereas a large to overwhelming majority agreed in all 10 other programs. (See table on next page.)

Teaching Effectiveness of T.A.s. Using the same scale employed in the previous item, the students were also asked to rate the percentage of T.A.s who were "effective as teachers in leading class discussions and/or labs" [UMPEQ #37B]. Here the response was worse, with the average, calculated as above, indicating that:

2) 52.7% of the T.A.s were effective as teachers.

Again there were differences between some of the program ratings, with EECS and IEOR again being lowest (with 44% of T.A.s rated as effective teachers), and Geology again highest (with 69%) [F-prob.= .0039]. Geology was again rated ahead of Mechanical Engineering (49%). Chemistry (59% of T.A.s as effective teachers), Materials Science (57%), L&S Computer Science (57%) and perhaps Physics (56%) also tended to significantly above EECS and IEOR. Only in the five highest-rated programs did a majority of the respondents agree that 60% or more of their T.A.s were effective as teachers in leading class discussions and/or labs.

Item: Approximately what percentage of T.A.s (upper or lower division) in your program: Are knowledgeable and well-prepared in the material being taught? [UMPEQ Q37A].

TOTALS — Engineering and Physical Sciences

5% 1=(0-20%) 33% 5=(81-100%)
11% 2=(21-40%) 19% 3=(41-60%) 32% 4=(61-80%)
Mean: 3.77 ± 0.10 (542) F-probability = .0002

Prog.	Mean	95% Conf.	N								
IEOR	3.33	± 0.34	(21)	NuclE+	3.71	± 0.38	(24)	LSComp	3.79	± 0.31	(52)
EECS	3.34	0.27	(71)	ChemE	3.72	0.30	(61)	*SocS79	3.79	0.12	(439)
MechE	3.61	0.28	(83)	CivilE	3.77	0.27	(74)	MSE+	3.92	0.43	(25)
*XsferE	3.67	0.58	(21)	*XsfLSC	3.77	0.58	(22)	Math	3.94	0.43	(31)

Chem	4.06	± 0.36	(36)
Physic	4.35	0.31	(40)
Geol	4.42	0.50	(24)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: Approximately what percentage of T.A.s (upper or lower division) in your program: Are effective as teachers in leading class discussions and/or labs? [UMPEQ Q37B].

TOTALS — Engineering and Physical Sciences

14% 1=(0-20%) 16% 5=(81-100%)
18% 2=(21-40%) 23% 3=(41-60%) 28% 4=(61-80%)
Mean: 3.13 ± 0.11 (528) F-probability = .0039

Prog.	Mean	95% Conf.	N								
EECS	2.70	± 0.29	(70)	*XsferE	3.11	± 0.70	(19)	Math	3.22	± 0.48	(27)
IEOR	2.71	0.38	(21)	ChemE	3.12	0.34	(60)	Physic	3.29	0.45	(38)
MechE	2.94	0.29	(83)	*XsfLSC	3.14	0.63	(21)	*SocS79	3.32	0.12	(440)
NuclE+	3.04	0.36	(23)	CivilE	3.17	0.33	(69)	LSComp	3.33	0.33	(52)

MSE+	3.33	± 0.44	(24)
Chem	3.47	0.37	(36)
Geol	3.96	0.57	(25)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Non-English-speaking T.A.s. In the engineering departments, an inquiry was also made about the extent of students' difficulties with the use of T.A.s "whose skill in the English language was simply not yet adequate" [ESQ #15]. Overall, a large majority of the respondents agreed (S.D. 7-19/9/30-35% S.A.) that they had had one or more T.A.s whose skills in English were inadequate. With 35% agreeing strongly, it is probably safe to assume that at least one-third of the majors had had a severe problem with at least one T.A. (or been faced with multiple occasions when there was at least some difficulty). There were no statistically significant differences between the program ratings [F-prob.= .5198].

Item: I have had one or more teaching assistants (T.A.s) whose skill in the English language was simply not yet adequate. [ES Q15].

TOTALS — Engineering

7% Str. Disagree 35% Str. Agree
19% Disagree 9% In Between 30% Agree
Mean: 3.68 ± 0.14 (348) F-probability = .5198

Prog.	Mean	95% Conf.	N								
ChemE	3.35	± 0.38	(55)	MSE+	3.67	± 0.61	(24)	CivilE	3.74	± 0.32	(72)
IEOR	3.60	0.53	(20)	MechE	3.69	0.30	(83)	NuclE+	3.78	0.61	(23)

EECS	3.86	± 0.26	(71)
*XsferE	4.00		(22)

*These responses have been excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Summary of Problems by Program: Elements of Teaching

Elements of teaching treated in this section include: the adequacy of feedback to students on their work: the availability of extra help: the sufficiency of coverage in the classroom of social issues and, in the engineering departments, of social responsibilities and ethics; the challenge, quality and motivational impact of the teaching; and teaching assistants--their knowledge and preparation, effectiveness as teachers and, in the engineering departments, the prevalence of T.A. difficulties with the English language.

In all of the engineering programs (including Chemical Engineering, but with Nuclear Engineering least so), there tended to be insufficient concern about social issues shown by faculty in the course of their teaching and a desire by students for more emphasis on the social responsibilities and ethics related to the profession and its practice. EECS IEOR MechE ChemE CivilE NuclE+ MSE+

Comments and review by professors and teaching assistants (T.A.s) on students' midterms, problem sets, papers, experiments and class performance were not usually considered thorough enough (IEOR being slightly better here). Fewer than half of the T.A.s were seen as effective teachers or discussion leaders in EECS and IEOR, and only narrow majorities were typical in the other engineering responses. One or more T.A.s with inadequate skills in the English language had been experienced by a large majority of the majors in all the engineering departments. The knowledge level or preparedness of T.A.s was also somewhat problematic in EECS and IEOR. The availability of additional help, or referral to assistance, seemed somewhat weak in EECS, and far from strong in the other departments. In IEOR, the challenge, quality, and motivational stimulus in faculty teaching was relatively low.

In Math, the challenge, quality and motivational impact of faculty teaching was relatively low, feedback on students' work by professors and T.A.s not really thorough enough, and the teaching effectiveness of many T.A.s not really up to a reasonable level. Math

Among L&S Computer Science majors, and to a lesser extent among Chemistry students, faculty seemed not to show enough concern about social issues in their classroom teaching. Comments or review by faculty and T.A.s on students' work was also somewhat less than thorough enough. The teaching effectiveness of T.A.s just began to reach more reasonable levels. Though Physics received slightly higher-ranking mean ratings in two of these three areas, its ratings were not particularly strong either. L&S Computer Science students also seemed to have some difficulty finding access to further explanation or obtaining referrals for assistance beyond the classroom. LSComp Chem Physic

In Geology, faculty concern about social issues in teaching their classes was not really sufficient. Geol

FACULTY-STUDENT CONTACT

Introduction and Crossreferences. The UMPEO sought information on faculty-student contact by means of items concerned with: satisfaction with the extent of student contact with faculty; the number of discussions with faculty members outside of class; the extent students are known by faculty members; the degree of comfortable access to a faculty advisor; and the prospects for a good letter of recommendation. The subsequent section focuses on students' more general perceptions of faculty receptivity, support and concern. Apropos of the information needed by students being advised, see also the section on "Provision of Information to Students" (pages 60-68).

Satisfaction with Professorial Contact. A slight plurality of the respondents disagreed (S.D. 11-26/28/26-8% S.A.)* that they have been satisfied with the level of interaction they have had with professors at UCB [UMPEQ #22]. In one program, Geology, a large majority agreed (4-8/27/42-19), but in only two others did as much as a plurality agree. The ratings for Geology tended to be significantly higher than those in nine other programs, where pluralities typically disagreed [F-prob.= .0304]. The programs where the level of student contact with faculty is least satisfactory include: L&S Computer Science (22-28/26/20-4), Chemical Engineering (18-29/21/24-8), IEOR (10-35/30/15-10), Materials Science (8-32/28/32-0), EECS (11-24/35/24-5), Math (16-14/35/32-3), Civil Engineering (5-37/24/26-8), Physics (10-25/35/20-10) and Mechanical Engineering (14-25/21/29-11).

Item: I have been satisfied with the level of interaction I have had with professors here. [UMPEQ Q22]. [1979 wording: Even though I might initially have expected more contact with professors, . . . professors than....]

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
LSComp	2.36	± 0.32	(54)	EECS	2.89	± 0.25	(74)
ChemE	2.76	0.31	(62)	Math	2.92	0.37	(37)
IEOR	2.80	0.54	(20)	CivilE	2.95	0.25	(76)
MSE+	2.84	0.41	(25)	Physic	2.95	0.36	(40)

TOTALS — Engineering and Physical Sciences

11% Str. Disagree, 26% Disagree, 28% In Between, 8% Str. Agree, 26% Agree

Mean: 2.93 ± 0.09 (358) F-probability = .0304

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
MechE	2.98	± 0.27	(85)	Chem	3.19	± 0.30	(36)
*SocS79	3.01	0.11	(475)	*XsfLSC	3.25	0.32	(24)
*XsferE	3.05	0.34	(22)	Geol	3.63	0.41	(26)
NuclE+	3.13	0.51	(23)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Discussions with Faculty Outside of Class. The UMPEQ also sought to establish the extent of student-faculty contact by means of "behavioral" reports as well as student opinions. One such measure of contact is the number of discussions students have had with faculty members outside of the classroom setting (in the last three months, exclusive of vacation periods), excluding study-list advising [UMPEQ #15]. The median as well as the mean number of such student-faculty discussions was about 3.5, or a little over one per month per student. Approximately one-sixth of the students had not been involved in any discussions with faculty outside of class in the previous three months of academic sessions, and three out of ten had participated in only one or two. There were no significant differences between the program ratings [F-prob.= .2957]. The data table is on the next page.

Extent Students Are Known to Faculty Members. In another "behavioral" approach to the assessment of the quality of relationships developed between students and faculty, the students were asked, in three progressive steps, about the extent to which they were known by faculty at UCB. Across the sample, the median student was known by sight to six UCB faculty members, by name to three, and to some extent as an individual person by one faculty member [UMPEQ #14A-C]. Although statistically significant differences between program ratings occurred only on the first of these three items [F-probs.= .0121, .1879, and .2347, respectively], EECS and IEOR invariably received the lowest average ratings, and only Civil Engineering was consistently rated fairly highly. On the item concerning the number of faculty members who know the student by sight, the median student in the highest-rated programs, Materials Science and Math, was known to eight or nine faculty members at UCB, while the median in the lowest, EECS, was three (to four).

The number of faculty who know the student to some extent as an individual person is, of course, the most crucial of the measures in assessing the depth or quality of the relationships, and the results were not cause for much optimism:

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Item: About how many Berkeley faculty members:

KNOW YOU by sight? [UMPEQ Q14A.]

TOTALS — Engineering and Physical Sciences

6% Zero | 8% Four | 7% Eight
6% One | 11% Five | 34% Nine or more
7% Two | 6% Six
10% Three | 5% Seven

Mean: 3.71 ± 0.26 (346) F-probability = .0121

Prog.	Mean	95% Conf.	N				
EECS	4.39	± 0.76	(72)	Geol	5.54	± 1.23	(26)
*XsferE	4.63	1.63	(19)	Physic	5.58	0.85	(40)
IEOR	5.24	1.28	(21)	Chem	5.61	1.06	(36)
ChemE	5.73	± 0.77	(39)	MechE	5.93	± 0.64	(87)
LSComp	5.75	0.91	(31)	CivilE	6.10	0.74	(73)
*XsfLSC	5.88	1.25	(24)	Math	6.70	0.95	(37)
NuclE+	5.91	1.25	(22)	MSE+	7.05	1.08	(22)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: About how many Berkeley faculty members:

KNOW YOU by name? [UMPEQ Q14B.]

TOTALS — Engineering and Physical Sciences

15% Zero | 9% Four | 3% Eight
15% One | 8% Five | 17% Nine or more
14% Two | 4% Six
13% Three | 3% Seven

Mean: 3.76 ± 0.26 (345) F-probability = .1879

Prog.	Mean	95% Conf.	N				
EECS	2.80	± 0.76	(71)	*XsferE	3.57	± 1.51	(21)
IEOR	3.05	1.30	(21)	NuclE+	3.67	1.34	(21)
Chem	3.38	0.92	(37)	Physic	3.68	0.92	(40)
MechE	3.73	± 0.69	(86)	CivilE	4.32	± 0.76	(73)
LSComp	3.76	0.86	(30)	MSE+	4.48	1.37	(23)
ChemE	3.90	0.83	(60)	Geol	4.58	1.05	(26)
Math	4.24	1.03	(37)	*XsfLSC	4.64	1.46	(22)

Item: About how many Berkeley faculty members:

KNOW YOU to some extent as an individual person? [UMPEQ Q14C.]

TOTALS — Engineering and Physical Sciences

39% Zero | 3% Four | 1% Eight
22% One | 5% Five | 2% Nine or more
13% Two | 2% Six
10% Three | 1% Seven

Mean: 1.60 ± 0.17 (325) F-probability = .2347

Prog.	Mean	95% Conf.	N				
IEOR	0.94	± 0.67	(18)	MechE	1.49	± 0.42	(84)
EECS	1.07	0.36	(71)	MSE+	1.52	0.83	(23)
LSComp	1.44	0.34	(30)	*XsfLSC	1.55	0.78	(24)
ChemE	1.63	± 0.63	(56)	Physic	1.97	± 0.70	(39)
Math	1.67	0.72	(36)	Geol	2.04	0.83	(25)
NuclE+	1.76	0.94	(21)	CivilE	2.04	0.54	(68)
Chem	1.76	0.62	(34)	*XsferE	2.05	0.87	(19)

Item: About how many times did you have a discussion outside of the classroom with any professor, apart from study-list advising, in the last three months of instruction (i.e., excluding vacation periods)? [UMPEQ Q15.] [1979 wording: ~~of instruction (every excluding vacation periods)~~?]

TOTALS — Engineering and Physical Sciences

16% None | 21% Seven or more
29% One or two | 13% Five or six
20% Three or four

Recoded Mean: 3.46 ± 0.22 (360) F-prob. = .2957*,

Prog.	*Reco. Mean	*95% Conf.	N				
*XsfLSC	2.63	± 1.05	(24)	*Socs79	3.01	± 0.22	(495)
EECS	2.90	0.60	(74)	*XsferE	3.05	1.21	(22)
ChemE	3.01	0.68	(61)	LSComp	3.09	0.71	(52)
				Chem	3.38	0.94	(37)
CivilE	3.54	± 0.38	(77)	Math	3.75	± 0.89	(38)
MSE+	3.58	1.12	(25)	IEOR	3.86	1.37	(21)
NuclE+	3.58	1.12	(24)	Physic	4.16	0.89	(40)
MechE	3.59	0.37	(95)	Geol	4.35	1.14	(25)

***The original metric for this question is shown in the labels with the percentages in the "TOTALS" section. In calculating the grand mean, program means and F-probability, however, the original responses were recoded as follows: "None"= 0, "One or two"= 1.5, "Three or four"= 3.5, "Five or six"= 5.5, and "Seven or more"= 7.5. The means thus approximate the actual number of out-of-class discussions with faculty members, though there is presumably some understatement in that the 21% responding "Seven or more" may average more than 7.5 discussions each. (The median response, "Three or four," is the same in either case.)

Item: At least one professor in this program knows me or my work well enough to write me a good recommendation for graduate school or a job. [UMPEQ Q24].

TOTALS — Engineering and Physical Sciences

2% Str. Disagree | 19% Str. Agree
23% Disagree | 12% In Between | 21% Agree

Mean: 2.86 ± 0.12 (345) F-probability = .0002

Prog.	Mean	95% Conf.	N				
EECS	2.36	± 0.34	(72)	*XsferE	2.82	± 0.37	(22)
LSComp	2.38	0.35	(33)	Math	2.86	0.49	(37)
MechE	2.58	0.32	(85)	*Hlth77	2.87	0.13	(423)
ChemE	2.74	0.39	(61)	*XsfLSC	2.92	0.63	(24)
MSE+	2.92	± 0.67	(24)	Chem	3.24	± 0.46	(34)
*Socs79	2.98	0.13	(478)	*Hum77	3.26	0.17	(274)
NuclE+	3.04	0.66	(23)	IEOR	3.32	0.72	(19)
CivilE	3.05	0.32	(74)	Physic	3.41	0.31	(39)
				Geol	3.75	0.60	(24)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: I have a regular faculty advisor (or otherwise know a faculty member in my program) to whom I would feel real comfortable going at any time during the year. [UMPEQ Q20].

TOTALS — Engineering and Physical Sciences

16% Str. Disagree | 21% Str. Agree
18% Disagree | 19% In Between | 26% Agree

Mean: 3.18 ± 0.11 (334) F-probability = .0000

Prog.	Mean	95% Conf.	N				
LSComp	1.96	± 0.33	(49)	*Socs79	3.07	± 0.13	(474)
MSE+	2.92	0.57	(25)	Math	3.08	0.46	(38)
MechE	3.03	0.24	(87)	*XsferE	3.14	0.63	(21)
EECS	3.05	0.31	(73)	Physic	3.18	0.43	(38)
*XsfLSC	3.30	± 0.33	(23)	IEOR	3.60	± 0.67	(20)
CivilE	3.33	0.32	(76)	ChemE	3.72	0.32	(61)
Chem	3.49	0.43	(37)	Geol	3.96	0.34	(26)
NuclE+	3.54	0.61	(24)				

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

39% of the respondents were not known to some extent as an individual person to any UCB faculty members, and another 22.5% were known only to one. Although the means of the programs were not significantly different from one another, there appeared to be some program differences occurring in the proportion of students choosing responses "zero" and "one" [Chi-square prob.= .0043, for 12 programs by 10 response categories].[1] The proportion of students known to some extent as individuals by zero UCB faculty members varied from lows of 24% in Geology and 29% in Civil Engineering to highs of 56% in IEOR and 49% in EECS. The table of program means is shown on the previous page.

Faculty Advising. Whether providing access for students to at least one faculty member involves the development of an effective departmental advising system or relies on a more informal outreach and receptivity by faculty, or some mix of the two, it seems important that all students have at least one faculty member to whom they can feel comfortable going. Hence, whatever the actual amounts of contact between faculty and students, it may be especially important for students to have a regular faculty advisor (or otherwise know a faculty member) in their program to whom they would feel comfortable going at any time during the year. When asked a question to this effect, a plurality of the respondents agreed (S.D. 16-18/19/26-21% S.A.) that they had a regular faculty advisor or other faculty member to whom they could comfortably go [UMPEQ #20]. But differences between the highest and lowest-rated programs were "very substantial" [F-prob.= .0000]. L&S Computer Science, where a large majority of students disagreed, a narrow majority strongly so (51-14/24/8-2), received ratings lower than all of the other programs! In the highest-rated programs, agreement ranged from very large to simple majorities, in the following order: Geology (8-12/8/23-50), Chemical Engineering (3-21/10/31-34), IEOR (15-10/5/40-30), Chemistry (5-22/22/22-30) and Civil Engineering (17-11/21/25-26). The ratings for Geology and Chemical Engineering tended to be significantly higher than those observed in programs where students agreed only by a plurality or a bare majority that they had a faculty member to whom they could comfortably go for advice. In addition to L&S Computer Science, the other low-rated programs were: Materials Science (24-12/24/28-12), Mechanical Engineering (10-22/31/28-9), EECS (18-18/21/29-15) and Math (21-16/11/39-13).

Letters of Recommendation. Though the matter of access to good letters of recommendation borders on the topic of faculty receptivity to students, which is treated in the next section, it is included here because such letters can make a crucial difference in the student's access to (the better) graduate schools and starting career positions. Assuming that almost all UCB students have capabilities and/or qualities that would lend themselves to obtaining a good letter of recommendation, the UMPEQ asked only whether at least one professor in their program knew them or their work well enough to write a good recommendation for graduate school or a job [UMPEQ #24]. Overall, a plurality of the respondents disagreed (S.D. 25-23/12/21-19% S.A.). With large majorities disagreeing in EECS (38-28/10/11-14) and L&S Computer Science (30-32/13/19-6), the ratings were significantly lower than those for about six other programs. Where disagreement prevailed by a bare majority or plurality, as in Mechanical Engineering (31-21/14/18-16) and Chemical Engineering (33-15/16/18-18), they were also significantly lower than the top-rated program. The highest ratings, with large majorities agreeing that they had access to at least one good letter of recommendation from a faculty member, went to Geology (8-17/13/17-46) especially, and to Physics (21-13/5/28-33), and majorities also agreed in IEOR (16-21/5/32-26) and Chemistry (9-29/12/29-21).

The data tables for the last two items reported here are shown on the previous page.

[1] The categories range from 0, 1, . . . to 8, and "9 or more."

Time did not permit a full study of the effects of students' class standing on their responses to the item about the availability of a good letter of recommendation from at least one faculty member. While there were perhaps some differences between programs in the proportions of students in junior and senior status [Chi-square prob.= .0434], the Pearson product-moment correlation between the two variables (for the entire sample) was 0.24, which suggests that senior status improves access to letters of recommendation by only 6%. The proportion of juniors and seniors in each program is shown in Appendix A (page A-2). The ratio of students to faculty also may account for some of the differences between programs.

Summary of Problems by Program: Faculty-Student Contact

This section dealt with several types of faculty-student contact and student access to advising and letters of recommendation. Items focused on the students' level of satisfaction with their interaction with faculty; the number of student-faculty discussions outside of class; the number of faculty members who know the student by sight, by name, and to some extent as an individual: the extent to which students have a regular faculty advisor or other faculty member to whom they comfortably can go; and the students' prospects for obtaining at least one good letter of recommendation from a faculty member.

LSComp
EECS
MechE
MSE+
Math
ChemE

Although "only" 36% of the L&S Computer Science majors felt that no faculty members knew them to some extent as an individual person, there was very seldom a faculty member, whether as a regular advisor or otherwise, to whom they comfortably could go if the need arose, and few of them indeed could get even one good letter of recommendation from a professor. Most were dissatisfied with the level of student-faculty interaction at UCB. EECS received almost equally poor ratings. Although EECS majors did have more comfortable (though still not good) access to faculty advice when needed, 49% of them were not known to some extent as individual persons by any faculty member. Similar, if somewhat (and progressively) less severe patterns of ratings occurred in Mechanical Engineering (with 45% of the majors not known in any depth) and, despite their being recognized by many faculty by sight, in Materials Science (with 43% not known as individuals) and Math (with "only" 36%). Except that comfortable access to faculty was readily available, Chemical Engineering students also rated their program as somewhat weak on these dimensions (with 41% not known to some extent as individual persons).

CivilE
NuclE+

About half of the majors in Civil Engineering and Nuclear Engineering were not particularly satisfied with the level of faculty-student interaction at UCB. Although lack of in-depth acquaintance with at least one faculty member occurred for "only" about 30% of these majors, only about half seemed to have good prospects for obtaining at least one good letter of recommendation.

IEOR

IEOR students were not particularly satisfied with the level of interaction with their professors and least of all felt that faculty members knew them to some extent as individuals (with 56% responding "zero" faculty members).

Physic
Chem

In Physics, satisfaction with the level of interaction with faculty was about average (somewhat low) and comfortable student access to faculty advice wasn't particularly good. In Chemistry, satisfaction with student-faculty interaction was a little higher and access to faculty advice a little better, but good letters of recommendation were not currently available to a large minority of the students. About a third of the majors in both departments were not known to some extent as individuals to any faculty member.

Geol Although given good (and the best) ratings on virtually all of the items concerning faculty-student contact, 24% of the Geology majors still felt themselves to be known to some extent as individuals to zero faculty members.

FACULTY RECEPTIVITY TO STUDENTS

While the previous section focused on the quantity, quality and availability of key student-faculty contacts, and on students' satisfaction with such interaction, examining in each case the sum of the individual responses made in reference to their own experiences, this section focuses more on the students' general perceptions of faculty receptivity, support and concern. Among the UMPEQ items included here are ones that focus on: perceptions of the level of faculty interest in and concern about undergraduates; the openness and extent of faculty-student communication; the acceptance of student input on course structure and content: and faculty receptivity to and support of male versus female, and Caucasian versus ethnic minority students.

Faculty Interest in and Concern about Undergraduates. In response to the proposition that faculty members in their program don't really seem interested in or concerned about undergraduates [UMPEQ #23], only a plurality of the respondents disagreed (S.D. 9-36/32/16-7% S.A.)* While only about half as many students agreed that there seems to be a lack of faculty interest/concern in undergraduates, strong affirmation that faculty seem interested or concerned was seldom found. There were no significant differences between the program ratings [F-prob.= .2263]; responses ranged only from majority disagreement to plurality agreement.

Item: Faculty members in this program don't really seem interested in or concerned about undergraduates. [UMPEQ Q23]. [1977 wording: ~~don't really seem aren't~~ really . . . .]

TOTALS — Engineering and Physical Sciences

9% Str. Disagree 36% Disagree 32% In Between 16% Agree 7% Str. Agree

Mean: 2.77 ± 0.09 (549) F-probability = .2263

Prog.	Mean	95% Conf.	N								
NuclE+	2.50	± 0.37	(24)	*HltS77	2.64	± 0.10	(418)	*SHum77	2.71	± 0.13	(273)
*SocS79	2.56	0.10	(484)	IEOR	2.65	0.31	(20)	MechE	2.76	0.23	(93)
ChemE	2.58	0.27	(39)	Geol	2.65	0.43	(26)	*XsfarE	2.77	0.36	(22)
Physic	2.59	0.37	(39)	CivilE	2.68	0.22	(76)	Chem	2.78	0.39	(37)
EECS	2.85	± 0.25	(71)								
*XsfLSC	2.88	0.31	(24)								
MSE+	3.00	0.36	(25)								
LSComp	3.02	0.28	(32)								
Math	3.11	0.17	(35)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Faculty-Student Communication. A plurality of the Engineering and Physical Science Sample respondents agreed (S.D. 6-17/35/32-10% S.A.) that faculty-student communication is "open and fairly extensive" in their program [UMPEQ #21]. In Geology, which was rated significantly above all but about two of the other programs, agreement was by very large majority (4-4/16/28-48). Compared only to the lowest-rated program, several other programs tended to have significantly higher ratings too, with slim majorities or large pluralities agreeing that communication with faculty was open and fairly extensive [F-prob.= .0001]. These other, somewhat more highly-rated programs include Physics (3-13/31/41-13), IEOR (0-15/35/40-10), Chemistry (5-11/30/51-3), Math (6-11/34/40-9), Nuclear Engineering (13-0/46/25-17), Chemical Engineering (5-13/39/34-9) and Civil Engineering (3-21/36/32-10).

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Open and fairly extensive communication between faculty and students was least reported in L&S Computer Science (12-24/43/18-4%), and opinion was fairly evenly divided in Materials Science (8-24/32/36-0), EECS (7-21/37/33-3) and Mechanical Engineering (9-21/35/22-13). While few of these ratings are entirely disheartening, most of the programs have a way to go before matching the quality of student-faculty interaction in the Geology Department.

Item: Communication between faculty and students in this program is open and fairly extensive. [UMPEQ Q21].

TOTALS — Engineering and Physical Sciences

5% Str. Disagree, 17% Disagree, 35% In Between, 10% Str. Agree, 32% Agree

Mean: 3.22 ± 0.09 (544) F-probability = .0001

Prog.	Mean	95% Conf.	N								
LSComp	2.78	± 0.28	(51)	*XsfLSC	3.14	± 0.42	(22)	*HlcS77	3.28	± 0.10	(423)
MSE+	2.96	0.40	(25)	*XsfarE	3.14	0.50	(21)	ChemE	3.29	0.26	(56)
EECS	3.04	0.22	(73)	*SHum77	3.17	0.14	(275)	*SocS79	3.33	0.11	(469)
MechE	3.08	0.25	(86)	CivilE	3.25	0.23	(73)	NuclE+	3.33	0.49	(24)

Math	3.34	± 0.34	(35)
Chem	3.35	0.31	(37)
IEOR	3.45	0.42	(20)
Physic	3.49	0.31	(39)
Geol	4.12	0.45	(25)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Student Input in Classes. Most of the faculty were receptive to student input on class structure and content, agreed a plurality of the respondents (S.D. 3-14/38/38-6% S.A.) [UMPEQ #30]. The program ratings were fairly uniform statistically [F-prob.= .5703], with agreement reaching a large majority in one case, but otherwise consisting of a range from a narrow plurality to narrow majority agreement.

Item: Most of the faculty in this program are receptive to student input on class structure and content. [UMPEQ Q30].

TOTALS — Engineering and Physical Sciences

3% Str. Disagree, 14% Disagree, 38% In Between, 6% Str. Agree, 38% Agree

Mean: 3.31 ± 0.08 (524) F-probability = .5703

Prog.	Mean	95% Conf.	N								
*SHum77	2.92	± 0.13	(261)	MSE+	3.22	± 0.29	(23)	CivilE	3.29	± 0.19	(73)
Math	3.06	0.31	(35)	Chem	3.22	0.25	(32)	Geol	3.30	0.56	(23)
IEOR	3.15	0.46	(20)	*HlcS77	3.23	0.10	(390)	*SocS79	3.32	0.09	(455)
NuclE+	3.17	0.46	(23)	MechE	3.29	0.22	(80)	*XsfLSC	3.33	0.44	(24)

EECS	3.34	± 0.20	(68)
ChemE	3.41	0.21	(59)
LSComp	3.41	0.25	(51)
*XsfarE	3.42	0.46	(19)
Physic	3.59	0.36	(37)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Faculty Receptivity to and Support of Male and Female, and White and Ethnic Minority Students. Discrimination against certain classes of students is difficult to know about if one is not a recipient of it or a witness to it in some fairly overt form. Hence, some students (19-24%) probably did not feel they could answer the items about whether faculty seemed to favor one sex, or one ethnic group or another [UMPEQ #38A-B]. But among those who ventured responses, a very large majority indicated that faculty were "Neither more nor less" supportive of and receptive to male than female students (Much/More 1-10/77/10-2% Much/Less).* An overwhelming majority also gave this middle response as regards white versus ethnic minority students (Much/More 3-10/83/2-1% Much/Less).*

In the case of faculty receptivity to and support of male and female students, program responses of "Neither more nor less" ranged from 61% to 93%, ranging at their most extreme (in either direction) to one pattern of response where some students perceive a slight bias in favor of men (Much/More 8-16/72/0-4% Much/Less, in Geology) [Chi-square prob.= .0480]. But there were no statistically significant differences between any of the program means [F-prob.= .2008] and all of the 95% confidence intervals at least barely intersected the midpoint of the scale. The data table is shown on the next page.

*The reporting procedure remains the same here (see footnote, page 28), with the scale ranging from "Much more" and "More," through "Neither more nor less," to "Less" and "Much less."

In the case of faculty receptivity to and support of white and ethnic minority students, the program percentages for the number of students choosing the "Neither more nor less" response ranged only from 77 to 97% [Chi-square prob.= .5077]. Patterns of responses by program ranged at their most extreme (in either direction) to one appearing ever so slightly to suggest the majors perceive some favoritism toward whites (Much/More 6-17/78/0-0% Much/Less,* in IEOR). The mean for the entire sample (2.88 ± 0.05) does not intersect the midpoint of the scale, possibly indicating a perception of a slight bias away from ethnic minority students. All but one of the engineering departments (and also Chemistry and Geology) were rated at or below the grand mean, but almost all the 95% confidence intervals intersected the scale's midpoint, and there were no statistically significant differences between any of the mean program ratings [F-prob.= .3521].

In view of the concentration of student responses to both of these items in only one of the five response categories, the various statistical tests may well not be as useful or valid as they normally are. Moreover, the perception of any differential in faculty receptivity to or support of male versus female, or white versus ethnic minority students, does not guarantee its existence in reality--though it may suggest the importance of circumspection in some instances. In addition, both the perception (and reality, if any) may in fact result from student interactions with only a few of the faculty members they have experienced. The ARU would certainly warn against drawing anything but the most tentative "conclusions" from these data.

Item: Using the rating scale which follows, please complete the two sentences below by filling in the number of the response that best describes your views: Generally speaking, the faculty in this program seem to be _____ supportive of and receptive to male than female students. [UMFEQ Q38A].

TOTALS — Engineering and Physical Sciences

1% Much more
10% More
77% Neither more nor less
2% Much less
10% Less

Mean: 3.01 ± 0.05 (455) F-probability = .2008

Prog.	Mean	95% Conf.	N								
*XsferF	2.75	± 0.39	(12)**	Physic	2.90	± 0.13	(30)**	LSComp	3.00	± 0.19	(43)	MechE	3.13	± 0.14	(60)**
Geol	2.76	0.32	(25)	ChemE	2.96	0.20	(43)**	CivilE	3.01	0.14	(71)	MSE+	3.13	0.22	(20)
Math	2.89	0.22	(25)**	EECS	2.98	0.11	(63)	NuclE+	3.10	0.26	(20)	IEOR	3.17	0.43	(18)
*XsfLSC	2.89	0.22	(19)	*SocS79	2.99	0.05	(391)	Chem	3.13	0.15	(32)				

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Item: Using the rating scale which follows, please complete the two sentences below by filling in the number of the response that best describes your views: Generally speaking, faculty in this program seem to be _____ supportive of and receptive to white than ethnic minority students. [UMFEQ Q38B].

TOTALS — Engineering and Physical Sciences

1% Much more
10% More
83% Neither more nor less
1% Much less
2% Less

Mean: 2.88 ± 0.05 (427) F-probability = .3521

Prog.	Mean	95% Conf.	N								
*XsferE	2.69	± 0.29	(13)**	*XsfLSC	2.79	± 0.20	(19)	CivilE	2.88	± 0.13	(64)	Physic	2.97	± 0.07	(30)**
IEOR	2.72	0.29	(18)	EECS	2.81	0.12	(67)	Chem	2.88	0.17	(26)**	LSComp	3.03	0.19	(38)**
MSE+	2.77	0.27	(22)	MechE	2.84	0.16	(36)**	*SocS79	2.90	0.06	(334)**	Math	3.08	0.17	(24)**
Geol	2.79	0.26	(19)**	ChemE	2.84	0.21	(44)**	NuclE+	2.95	0.25	(19				

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Summary of Problems by Program: Faculty Receptivity to Students

"Faculty receptivity" is defined here to include student perceptions of faculty members' apparent interest in or concern about undergraduates, the openness

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*The reporting procedure remains the same here (see footnote, page 28), except that the scale ranges from "Much more" and "More," through "Neither more nor less," to "Less" and "Much less."

and extent of faculty-student communication, the receptivity in the classroom to student input on course structure and content, and the reaction to male as contrasted with female, and white as compared to ethnic minority students.

Majors in L&S Computer Science, Materials Science and EECS were no more than equally divided in their views as to whether faculty in their program are interested in and concerned about undergraduates, and also regarding the openness and extent of faculty-student communication. LSComp MSE+ EECS

In Math, faculty interest in and concern about undergraduates was also a matter of some doubt, and the respondents were also fairly evenly divided as to whether faculty were receptive to student input on course structure and content. Math

There was some question in Mechanical Engineering about whether faculty-student communication was open and fairly extensive. MechE

Judging purely by absolute distances of mean ratings from the midpoint of the scale (but while cognizant of the 95% confidence intervals), ratings in IEOR perhaps suggested that faculty did not seem quite as receptive to and supportive of ethnic minority students as they were to whites, and in Geology there were a few questions raised about whether the women students receive as much support as the men.* IEOR Geol

AFFIRMATIVE ACTION

Introduction and Crossreferences. This section is concerned with student opinions about whether there are enough women students, and enough ethnic minority students (here limited to Blacks, Chicanos and Native Americans) enrolled in their program, and about whether there are enough women faculty, and enough ethnic minority faculty (ethnic groups unlimited) in that same program. The faculty's apparent receptivity to and support of women students, and of ethnic minority students (ethnic groups unlimited) is treated in the immediately preceding section, including in the summary.

Student opinion on the matters considered in this section may of course reflect some mixture of the effects of the existing number of faculty and students who are women or members of ethnic minority groups, the proportional utilization of existing availability pools (e.g., the proportion of women who hold a doctorate in engineering department X) and, perhaps varying by program, the students' own receptivity to the need to diversify the sexual and ethnic constitution of departmental faculties and the professions.

*Please see the qualifications throughout the body of the text concerning these data.

Enrollment of Women and Ethnic Minority Students

In the opinion of the students in the Engineering and Physical Science programs, the proportion of women students was too low [UMPEQ #64]. Overall, a large majority agreed (S.D. 5-13/18/30-34% S.A.),* as did a plurality or more of the respondents in each of the programs. Very large to overwhelming majorities of the respondents felt women students to be underrepresented in EECS (2-5/16/28-49), Mechanical Engineering (3-5/10/38-44), Nuclear Engineering (5-9/0/41-46), Physics (3-9/17/23-49) and Materials Science (0-10/19/38-33). The ratings in EECS, Mechanical Engineering and Nuclear Engineering tended to be significantly worse than those in programs where agreement was by plurality to large majority, and Physics and Materials Science were also rated as having a greater shortage of women students than in the one program where agreement was by only a plurality [F-prob.= .0000]. Programs where the respondents saw women students as least underrepresented included L&S Computer Science (13-19/26/28-15), Geology (4-33/21/21-21) and Chemistry (6-23/29/16-26) and, though the opinions were that underrepresentation existed, in Chemical Engineering (7-18/20/23-32), Civil Engineering (4-17/19/32-27) and Math (6-12/15/45-21).

A majority of the respondents also agreed (S.D. 8-14/24/34-21% S.A.) that the proportion of Black, Chicano and Native American students in their program was too low [UMPEQ #65]. A plurality or more of the respondents in each of the programs again agreed that these three ethnic minority groups were underrepresented. There were no statistically significant differences between the program ratings [F-prob.= .5640], but L&S Computer Science was again ranked lowest in underrepresentation (at 13-15/28/34-11), and Mechanical Engineering (6-11/19/36-28) was again high, along with Geology (0-21/17/33-29).

Item: In my opinion, the proportion of women students in this program is too low. [UMPEQ Q64].

TOTALS — Engineering and Physical Sciences

5% Str. Disagree, 13% Disagree, 18% In Between, 34% Str. Agree, 30% Agree

Mean: 3.76 ± 0.10 (300) F-probability = .0000

Prog.	Mean	95% Conf.	N								
*XsfLSC	3.05	± 0.69	(20)	ChemE	3.35	± 0.35	(56)	MSE+	3.95	± 0.44	(21)	MechE	4.16	± 0.22	(77)
LSComp	3.13	0.37	(47)	CivilE	3.61	0.28	(70)	*XsfarE	4.05	0.56	(20)	EECS	4.19	0.24	(67)
Geol	3.21	0.53	(24)	Math	3.64	0.40	(33)	Physic	4.06	0.39	(35)				
Chem	3.32	0.47	(31)	IEOR	3.82	0.55	(17)	NuclE+	4.14	0.30	(22)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: In my opinion, the proportion of Black, Chicano and Native American students in this program is too low. [UMPEQ Q63].

TOTALS — Engineering and Physical Sciences

8% Str. Disagree, 14% Disagree, 24% In Between, 21% Str. Agree, 34% Agree

Mean: 3.45 ± 0.11 (471) F-probability = .3640

Prog.	Mean	95% Conf.	N								
LSComp	3.13	± 0.35	(47)	CivilE	3.32	± 0.33	(63)	Physic	3.30	± 0.41	(10)**	MechE	3.69	± 0.27	(72)
*XsfLSC	3.13	0.61	(20)	Math	3.37	0.40	(30)	MSE+	3.32	0.51	(21)	Geol	3.71	0.47	(24)
IEOR	3.22	0.55	(18)	Chem	3.43	0.43	(28)	EECS	3.53	0.25	(64)				
NuclE+	3.26	0.70	(19)	ChemE	3.49	0.35	(55)	*XsfarE	3.60	0.59	(20)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Representation of Women and Ethnic Minorities on the Faculties

With 77.5% choosing one of the 1-5 scaled response categories, the respondents were generally of the opinion that women are underrepresented on their program's faculty [UMPEQ #34]. Overall, a large majority disagreed (S.D. 34-34/13/14-4% S.A.) that there are enough women faculty. With 54% or more of the students

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

disagreeing in every program, the differences between the program ratings were at most of borderline significance statistically [F-prob.= .0809], but the confidence interval for Geology, where an overwhelming majority disagreed (55-40/0/5-0%) that there are enough women faculty, did not intersect with the confidence interval for several other programs.

The sufficiency in number of ethnic minority faculty was rated as less severe than in the case of women faculty by the respondents, 76.5% of whom chose from among the 1-5 scaled response categories [UMPEQ #35]. Overall, only a plurality disagreed (S.D. 19-25/22/24-11% S.A.) that there are enough ethnic minority faculty in their program. The highest level of disagreement was again found in Geology (37-32/11/21-0), with IEOR (29-36/21/7-7) also rated as being rather short on ethnic minority faculty, though response rates were somewhat low in both programs (73% and 67%, respectively). The number of ethnic minority faculty tended to be regarded as more sufficient in the two programs with many double majors, Nuclear Engineering (10-25/10/30-25) and Materials Science (10-25/20/20-25), and also in EECS (13-19/19/39-11).

Item: In my opinion, there are enough women faculty in this program. [UMPEQ Q34]. [1977, 1979 wording: In my opinion, ...]

TOTALS — Engineering and Physical Sciences

34% Str. Disagree, 34% Disagree, 13% In Between, 4% Str. Agree, 14% Agree

Mean: 2.21 ± 0.11 (438) F-probability = .0809

Prog.	Mean	95% Conf.	N							
Geol	1.55	± 0.26	(20)	IEOR	2.15	± 0.65	(13)**	*XsfLSC	2.32	± 0.68 (19)
Chem	1.93	0.34	(30)	Physic	2.15	0.48	(25)**	Math	2.33	0.51 (27)**
ChemE	1.94	0.34	(53)	EECS	2.21	0.30	(62)	MechE	2.34	0.26 (68)
*XsfarE	2.15	0.31	(20)	CivilE	2.25	0.32	(60)	NuclE+	2.35	0.65 (20)
MSE+	2.40	± 0.58	(20)							
*SocS79	2.44	0.12	(404)							
*SHum77	2.57	0.17	(251)							
LSComp	2.64	0.41	(39)**							
*MltS77	2.67	0.14	(360)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Item: In my opinion, there are enough ethnic minority faculty in this program. [UMPEQ Q35]. [1977, 1979 wording: In my opinion, ...]

TOTALS — Engineering and Physical Sciences

19% Str. Disagree, 25% Disagree, 22% In Between, 11% Str. Agree, 24% Agree

Mean: 2.84 ± 0.12 (432) F-probability = .0237

Prog.	Mean	95% Conf.	N							
Geol	2.16	± 0.36	(19)**	*MltS77	2.37	± 0.13	(331)	Physic	2.68	± 0.46 (25)**
*SHum77	2.23	0.17	(219)	ChemE	2.55	0.37	(56)	LSComp	2.80	0.38 (40)**
IEOR	2.29	0.70	(14)**	*XsfLSC	2.65	0.67	(20)	CivilE	2.82	0.32 (60)
*SocS79	2.36	0.13	(282)	Chem	2.67	0.44	(27)**	MechE	2.89	0.33 (62)
Math	3.00	± 0.55	(25)**							
*XsfarE	3.00	0.73	(20)							
EECS	3.17	0.31	(64)							
MSE+	3.25	0.64	(20)							
NuclE+	3.35	0.65	(20)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Summary of Problems by Program: Affirmative Action

This section dealt with whether student views indicate that the numbers of women and ethnic minority faculty, and of women and Black, Chicano and Native American students, are too low in their program. See also page 29 for more information on faculty support of and receptivity to women and ethnic minority students.

The number of women faculty members in Geology was perceived as insufficient in the extreme. The number of ethnic minority faculty was also rated as very insufficient. Similar ratings, with somewhat less but still severe deficiencies in the number of women faculty, were observed in IEOR. Ratings suggesting shortages of women faculty equal to or worse than those found in IEOR, but with more moderate shortages perceived as regards ethnic minority faculty, were found in Chemical Engineering, Chemistry and Physics. Results were similar in Civil Engineering, except that only modest underrepresentation of ethnic minority faculty was perceived. The proportion of women students was seen as markedly low in Physics, and only a little less so in IEOR. It was still low in Civil Engineering and Chemical Engineering, and somewhat

Geol
IEOR
ChemE
Chem
Physic
CivilE

low in Chemistry and Geology. The proportion of Black, Chicano and Native American students was clearly regarded as too low in Geology; it was also low in Physics, Chemical Engineering and Chemistry, and was somewhat low in Civil Engineering and IEOR.

EECS
MechE
Math
NuclE+
MSE+

Fairly severe shortages of women faculty were also seen by students in EECS, Math, Mechanical Engineering, Nuclear Engineering and Materials Science, and the proportion of women students was seen as markedly low in all but Math, where it was still low. But the proportion of ethnic minority faculty was regarded as more or less adequate in these departments (perhaps not quite so in M.E.). Nevertheless, the proportion of Black, Chicano and Native American students in these programs was regarded as low, albeit only somewhat so in Math and Nuclear Engineering.

LSComp

In L&S Computer Science, the number of women faculty was still regarded as insufficient, though least so of any of the 12 programs, and the number of ethnic minority faculty was also judged to be somewhat low.

COMPETITION, TESTING, GRADING AND GPA

Introduction and Crossreferences

Questionnaire items gathered together under this rubric focus on aspects of UCB's academic evaluation/reward-punishment system. Student workload is treated in the next section (pages 42-56). Students' learning, including the likelihood of their retention of material learned and level of competency expected in several basic skill areas (by the time of their graduation), are discussed immediately thereafter (pages 56-60). The effectiveness of the various programs in enabling students to obtain a "thorough understanding of the subject matter" is covered on page 80. The influence of the instructional process as a whole on students' "overall growth and learning" is treated on page 76. The summary of problems by program is presented after all four subsections of this section.

COMPETITION AND ITS EFFECTS

This section of the evaluation of UCB's Engineering and Physical Science programs is concerned with the extent to which students feel they study and learn best with competition at the level currently found here, with their perception of the caliber or motivation of their peers and, in the engineering departments, with the extent to which humanities and social studies, and technical, electives are chosen more for their moderate workloads and convenience of scheduling than as important sources for general or supporting knowledge or understanding.

Competition. When asked whether they studied and learned best in an environment with competition at a level such as found at Berkeley [UMPEO #31], a modest plurality of the respondents agreed (S.D. 11-20/26/32-10% S.A.).* Although the

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

confidence interval for Geology (22-17/43/17-0%) did not overlap with that of Civil Engineering (3-19/35/29-14), where competition seemed most acceptable (albeit with several close competitors), most of the program means were bunched together, such that there were no statistically significant differences among the set of program means [F-prob.= .4443]. The distribution of student responses, however, was also of interest in the second-highest ranked Materials Science program, in that a large majority agreed that competition was beneficial to their learning, but "strong" disagreement outpolled "strong" agreement (17-9/13/48-13). Apart from Geology, the acceptance of the level of competition at UCB was greater in every engineering and physical science program than was found in the combined views of all the students in the programs in the Health-related Sciences, Social Sciences and Selected Humanities Samples, as well as in both groups of transfer students within the Engineering and Physical Science Sample.* In sum, the level of competition at UCB seemed more acceptable to Engineering and Physical Science students than to students in other majors, but those agreeing that competition helped them to study and learn represented only a modest plurality of the total, and strongly favorable reactions were equalled by strongly unfavorable ones. Overall, 42% viewed the competition positively, 26% were mixed, and 31% were unfavorable.

Item: I study and learn best in an environment with competition at a level such as we have here at Berkeley. [UMPEQ 31].

TOTALS -- Engineering and Physical Sciences

11% Str. Disagree, 20% Disagree, 26% In Between, 10% Str. Agree, 32% Agree

Mean: 3.11 ± 0.10 F-probability = .4443

Prog.	Mean	95% Conf.	N								
Geol	2.57	± 0.45	(23)	*XsfLSC	2.87	± 0.62	(23)	MechE	3.06	± 0.26	(83)
*HlcS77	2.68	0.12	(421)	*SHum77	2.90	0.17	(253)	ChemE	3.09	0.30	(38)
*SocS79	2.75	0.12	(458)	LSComp	2.94	0.31	(48)	Math	3.10	0.46	(31)
*XsfarE	2.86	0.48	(21)	EECS	3.00	0.29	(72)	Chem	3.20	0.44	(35)
Physic	3.21	± 0.37	(38)								
IEOR	3.25	0.37	(20)								
NuclE+	3.26	0.36	(23)								
MSE+	3.30	0.37	(23)								
CivilE	3.32	0.24	(72)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

The Competitors at UCB. A very large majority of the respondents agreed (S.D. 2-7/21/49-21% S.A.) that they had been impressed by the caliber or motivation of the other students in their major [UMPEQ #60]. The strongest responses, with overwhelming agreement or nearly so, such as observed in Physics (0-5/13/41-41), Nuclear Engineering (4-0/8/63-25), L&S Computer Science (0-4/19/46-31), Civil Engineering (0-3/21/57-20), and possibly also in Geology (0-12/15/42-31) and Chemical Engineering (3-3/16/57-20), were significantly higher than one or more of the programs where agreement was by plurality or simple majority, such as found in IEOR (0-15/45/35-5), Math (5-14/35/35-11) and even Materials Science (0-8/36/48-8) [F-prob.= .0003].

Item: I have been impressed by the caliber or motivation of the other students in this major. [UMPEQ 260].

TOTALS -- Engineering and Physical Sciences

2% Str. Disagree, 7% Disagree, 21% In Between, 21% Str. Agree, 49% Agree

Mean: 3.80 ± 0.08 (553) F-probability = .0003

Prog.	Mean	95% Conf.	N								
*SHum77	3.29	± 0.15	(263)	MSE+	3.36	± 0.32	(25)	EECS	3.75	± 0.22	(73)
IEOR	3.30	0.38	(20)	*HlcS77	3.63	0.10	(414)	*XsfLSC	3.78	0.41	(23)
Math	3.32	0.34	(37)	Chem	3.67	0.29	(36)	ChemE	3.87	0.23	(61)
*SocS79	3.35	0.10	(466)	MechE	3.70	0.22	(84)	Geol	3.92	0.39	(26)
CivilE	3.93	± 0.25	(76)								
LSComp	4.04	0.23	(52)								
NuclE+	4.04	0.36	(24)								
*XsfarE	4.09	0.41	(22)								
Physic	4.18	0.28	(39)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

*Within the Social Sciences Sample, however, Business students on the average (mean= 3.53) were more acceptant of UCB's level of competition than were students in any of the Engineering and Physical Science programs (and one of the remaining 13 Social Science programs was also as acceptant as any of those in the current sample). The transfer student groups are explained on page A-12.

Implications of Competition and Workload for Choice of Electives. In the engineering departments, the majors were asked to what extent they chose their humanities and social science classes, and their technical electives, "more with a view toward gaining some important general or supporting knowledge/understanding than for convenience of course scheduling, moderate workloads, etc." [ESO #6-7]. In the case of the humanities and social science courses, only a plurality of the students agreed (S.D. 10-22/20/29-18% S.A.) that they chose electives more for some important general or supporting knowledge or understanding. While there were no significant differences between the program means [F-prob.= .1367], choice of such courses for convenience of scheduling or moderate workloads may have been somewhat more prevalent in Nuclear Engineering (24-19/24/24-10) than in IEOR (5-11/16/42-26) or Materials Science (0-23/23/32-23).

In the area of technical electives (in engineering, physical sciences, math or statistics), very large to overwhelming majorities in all of the programs chose their courses more for general or supporting knowledge or understanding than for convenience of scheduling or moderate workloads. Overall, the majority agreeing was overwhelming (S.D. 3-5/10/44-39% S.A.). There were no differences between the program ratings (F-prob.= .5219), but Nuclear Engineering in this case was ranked highest (@ 5-0/5/27-64) rather than lowest.

Item: I tend(ed) to choose my humanities and social science courses more with a view toward gaining some important general or supporting knowledge/understanding than for convenience of course scheduling, moderate workload requirements, etc. [ES Q6].

TOTALS — Engineering

10% Str. Disagree, 22% Disagree, 20% In Between, 19% Str. Agree, 29% Agree

Mean: 3.23 ± 0.14 (340) F-probability = .1367

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
NuclE+	2.76	± 0.61	(21)	MechE	3.19	± 0.30	(83)	ChemE	3.32	± 0.35	(33)	IEOR	3.74	± 0.55	(19)
ESCS	3.03	0.28	(71)	CivilE	3.31	0.29	(71)	MSE+	3.53	0.49	(22)	*MafarE	3.86		(22)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-12, for more information.

Item: I tend(ed) to choose my technical electives (Eng./Phy. Sci./Math/Stat.) more with a view toward gaining some important general or supporting knowledge/understanding than for convenience of course scheduling, moderate workloads, etc. [ES Q7].

TOTALS — Engineering

1% Str. Disagree, 5% Disagree, 12% In Between, 39% Str. Agree, 44% Agree

Mean: 4.10 ± 0.10 (346) F-probability = .3219

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
IEOR	3.95	± 0.44	(20)	ChemE	4.02	± 0.26	(34)	MechE	4.12	± 0.22	(83)	*MafarE	4.40	±	(20)
MSE+	4.00	0.41	(23)	CivilE	4.03	0.23	(72)	ESCS	4.19	0.22	(72)	NuclE+	4.43	0.43	(22)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

TESTING

Clarity of Faculty Statements about Course Expectations. One possible key to a less competitive learning environment and to fairer play for those who are to be graded, is the clarity of the instructor's statement at the outset of a class about what will be covered and what students will need to know or do to get an "A" grade. This approach is also essential for development of mastery or workload-based standards which, though typically employed in self-paced courses, are not yet very prevalent in most traditional classes. Upon inquiry about whether faculty expectations were made clear early on in the students' courses [UMPEO #28],

it was found that a modest plurality of the respondents disagreed (S.D. 10-28/33/23-5% S.A.).* Approximately the same response was given in each of the programs [F-prob.= .5165], with IEOR students (0-29/29/38-5) reporting nominally more faculty clarity about what they would need to know or do to get an "A" grade.

Item: Faculty in my program clearly state at the outset what the course will cover and what students need to know or do to get an "A." [UMPEQ Q28].

TOTALS — Engineering and Physical Sciences

10% Str. Disagree, 28% Disagree, 33% In Between, 23% Agree, 5% Str. Agree

Mean: 2.85 ± 0.09 (551) F-probability = .5165

Prog.	Mean	95% Conf.	N								
Math	2.57	± 0.35	(35)	Geol	2.73	± 0.44	(24)	EECS	2.85	± 0.24	(74)	LSComp	2.98	± 0.29	(54)
MSE+	2.67	0.37	(24)	MechE	2.75	0.24	(85)	*ElcS77	2.95	0.10(421)		NuclE+	3.00	0.51	(24)
Physic	2.68	0.34	(38)	Chem	2.77	0.36	(35)	ChemE	2.95	0.29	(61)	*SocS79	3.01	0.09(473)	
*SHum77	2.70	0.13(256)		*XsferE	2.82	0.32	(22)	CivilE	2.96	0.23	(76)	*XsfLSC	3.18	0.38	(22)
												IEOR	3.19	0.42	(21)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Accuracy of Tests. Despite the relative lack of clarity by faculty about course expectations, when asked whether tests in most of their courses have fairly accurately measured their knowledge of course material, a majority of the respondents agreed, though few strongly so (S.D. 5-12/27/50-7% S.A.) [UMPEQ #27]. There were no statistically significant differences among the ratings [F-prob.= .5779]. In every program, at least a bare majority agreed and the highest level of agreement was by very large majority. However, in no program did strong agreement exceed 11% that tests were fairly accurate measures of the respondent's knowledge. (Strong disagreement also never went above 11%.)

Item: Tests given by faculty in most of my courses in this program have measured fairly accurately my knowledge of the material. [UMPEQ Q27]. [1977 wording: "in most of my courses" follows the word "material."]

TOTALS — Engineering and Physical Sciences

5% Str. Disagree, 12% Disagree, 27% In Between, 50% Agree, 7% Str. Agree

Mean: 3.42 ± 0.08 (563) F-probability = .3779

Prog.	Mean	95% Conf.	N								
ChemE	3.28	± 0.29	(61)	*ElcS77	3.36	± 0.10(419)		Physic	3.40	± 0.30	(40)	MSE+	3.52	± 0.38	(25)
*XsferE	3.29	0.41	(21)	Math	3.37	0.32	(38)	*SocS79	3.40	0.09(490)		MechE	3.54	0.18	(87)
EECS	3.30	0.24	(74)	*XsfLSC	3.39	0.39	(23)	NuclE+	3.42	0.45	(24)	IEOR	3.57	0.42	(21)
LSComp	3.31	0.26	(54)	CivilE	3.39	0.19	(76)	*SHum77	3.50	0.12(259)		Geol	3.62	0.40	(26)
												Chem	3.68	0.25	(37)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Time Pressure on Tests. In the engineering departments, the students were also asked whether too many of their program's midterms require more time than is allowed to complete them, such that the individual respondent's grades are unjustly influenced by the speed at which he/she has to work [ESO #21]. Overall, a plurality agreed (S.D. 5-26/24/24-21% S.A.) that too many of their midterm performances were unjustly influenced by a time-pressure factor. Differences between program ratings were of borderline significance at most [F-prob.= .0800], but Nuclear Engineering students alone tended to disagree (27-27/23/5-18) while agreement reached majority levels in Chemical Engineering (4-30/13/21-32) and Mechanical Engineering (4-24/19/28-25).

Item: Too many midterms in my program require more time for me to complete than is allowed, so that my grades are unjustly influenced by the speed at which I work. [ES Q21].

TOTALS — Engineering

5% Str. Disagree, 26% Disagree, 24% In Between, 24% Agree, 21% Str. Agree

Mean: 3.29 ± 0.13 (340) F-probability = .0800

Prog.	Mean	95% Conf.	N								
NuclE+	2.59	± 0.64	(22)	MSE+	3.21	± 0.33	(24)	EECS	3.30	± 0.24	(73)	ChemE	3.47	± 0.37	(53)
IEOR	3.07	0.68	(15)**	CivilE	3.23	0.27	(70)	MechE	3.47	0.26	(83)	*XsferE	3.86		(22)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories ranging from "Strongly Disagree" (S.D.) and Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Prevention of Cheating. In the engineering departments, students were also asked if their program's faculty take adequate measures to prevent cheating [ESQ #22]. A plurality of the respondents agreed that faculty do so, but few gave strongly affirmative answers (S.D. 6-17/32/39-5% S.A.). Although there were no differences between the program ratings [F-prob.= .2324], pluralities agreed in the large departments while majorities or large majorities agreed in the small ones. The average response for the large departments (EECS and Mechanical, Civil and Chemical Engineering) was: S.D. 7-19/34/35-5% S.A.; for the small departments (IEOR and Materials Science and Nuclear Engineering) it was: S.D. 0-13/29/52-6% S.A.

Item: The program's faculty take adequate measures to prevent cheating. [ES Q22].

TOTALS — Engineering

6% Str. Disagree, 17% Disagree, 32% In Between, 5% Str. Agree, 39% Agree

Mean: 3.21 ± 0.11 (317) F-probability = .2324

Prog.	Mean	95% Conf.	N								
*XsfarE	3.11		(18)	EECS	3.12	± 0.27	(67)	CivilE	3.17	± 0.21	(69)
MechE	3.11	± 0.25	(72)	ChemE	3.13	0.29	(47)	IEOR	3.42	0.37	(19)
MSE+	3.55	± 0.40	(22)								
NuclE+	3.37	0.34	(21)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

GRADING

Rigor of Grading. When asked whether grading in their program is more rigorous than in most others, and whether it is hard to get an "A" grade, a large majority of the respondents agreed (S.D. 1-10/23/34-32% S.A.)* [UMPEQ #26]. In the most rigorously rated programs, agreement tended to be by very large to overwhelming majority, such as found in Chemical Engineering (0-7/8/31-54), Nuclear Engineering (4-0/22/22-52), L&S Computer Science (0-4/13/53-30), Geology (0-9/17/30-43), Civil Engineering (0-7/25/37-32) and Mechanical Engineering (1-8/17/47-27). These ratings were indicative of student perceptions of significantly more rigorous grading than reported in one or more of the following programs: Materials Science (4-13/50/29-4), especially, and also Math (0-26/26/34-14), and even Chemistry (3-17/28/22-31), IEOR (0-10/38/33-19) and Physics (0-14/39/11-36) [F-prob.= .0000]. EECS (3-9/26/31-31), with a near-average rating compared to the sample as a whole, was significantly higher than Materials Science and significantly lower than Chemical Engineering in ratings of comparative grading rigor.

Item: Grading in this program is more rigorous than in most—it is very hard to get an "A." [UMPEQ Q26].

TOTALS — Engineering and Physical Sciences

1% Str. Disagree, 10% Disagree, 23% In Between, 32% Str. Agree, 34% Agree

Mean: 3.36 ± 0.08 (545) F-probability = .0000

Prog.	Mean	95% Conf.	N								
MSE+	3.17	± 0.37	(24)	Chem	3.61	± 0.40	(36)	EECS	3.78	± 0.23	(74)
*SocS79	3.27	0.09	(467)	IEOR	3.62	0.42	(21)	MechE	3.90	0.20	(86)
Math	3.37	0.35	(35)	Physic	3.69	0.38	(36)	CivilE	3.93	0.21	(73)
*SHum77	3.32	0.12	(271)	*MlcS77	3.78	0.09	(411)	*XsfarE	3.95	0.34	(20)
Geol	4.09	± 0.43	(23)								
LSComp	4.09	0.21	(33)								
*XsfLSC	4.13	0.45	(24)								
NuclE+	4.17	0.46	(23)								
ChemE	4.33	0.23	(61)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Proportion of Grade Given to Homework. In the engineering departments, the students were asked, given the amount of homework typically assigned in their program's courses, whether the proportion of the grade awarded for it is usually too low [ESQ #18]. Overall, a plurality agreed (S.D. 8-22/25/28-16% S.A.) that their homework was undervalued in the grading. There were no significant differences between the program ratings [F-prob.= .6085], with disagreement having a plurality in only one instance. Otherwise, responses that homework was undervalued in the grading ranged only from plurality to bare majority agreement. Giving a somewhat higher proportion of final course grades to homework, especially if teamwork by students is appropriate, could help to reduce competition and enhance the sense of cooperation (a trait that may well also be useful in the subsequent world of work). The engineering students were also asked whether they could learn the material just as well without as much homework in most of their classes. The responses to this item are treated under the section on "Student Workload" (see page 55).

Item: Given the amount of homework typically assigned in my program's courses, the proportion of the grade awarded for the homework is usually too low. [ES Q18].

TOTALS — Engineering

8% Str. Disagree | 22% Disagree | 25% In Between | 28% Agree | 16% Str. Agree

Mean: 3.23 ± 0.13 (348) F-probability = .6085

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
IEOR	3.30	± 0.32	(20)	EECS	3.22	± 0.29	(74)	MSE+	3.25	± 0.32	(24)
ChemE	3.11	0.36	(34)	NuclE+	3.23	0.49	(22)	CivilE	3.30	0.28	(70)
MechE	3.37	± 0.25	(84)								
*MatSc	3.41		(22)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

"Absolute" Standards Vs. Grading on the "Curve" in the Engineering Departments. In the ARU's study of the health-related sciences, a whole series of items dealt with grading, competition and its effects, and alternatives to the current system. This series of questions perhaps implicitly helped the students to think about the most ideal grading systems. Also, many of the students in the health-related sciences face a special problem in gaining access to professional schools (and the bachelor's degree is no easy ticket to well-paid employment), particularly in medicine, where perhaps only 40% are eventually admitted.

In the Engineering Supplement, we included the one item that from the health sciences students had received the strongest agreement, a plurality, with 41% agreeing and 27% disagreeing. **When asked in the Engineering and Physical Science Sample, however, a majority disagreed** (S.D. 26-27/20/19-9% S.A.) that "rather than grading on a curve, professors should use pre-established 'absolute standards' that test for mastery of fundamentals rather than details" [ESQ #20]. Although differences between responses in the engineering departments were of borderline significance at most [F-prob.= .0691], the responses ranged from prevailing majority disagreement, such as found in Materials Science (36-23/18/23-0) and Nuclear Engineering (33-19/33/14-0), to the almost evenly divided views observed in EECS (15-26/20/24-15).

Item: Rather than grading on a curve, professors should use pre-established "absolute standards" that test for mastery of the fundamentals rather than details in my program's courses. [ES Q20].

TOTALS — Engineering

26% Str. Disagree | 27% Disagree | 20% In Between | 19% Agree | 9% Str. Agree

Mean: 2.58 ± 0.14 (337) F-probability = .0691

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
MSE+	2.27	± 0.53	(22)	ChemE	2.41	± 0.36	(31)	*MatSc	2.32		(21)
NuclE+	2.29	0.50	(21)	CivilE	2.43	0.30	(69)	MechE	2.54	± 0.30	(81)
IEOR	2.74	± 0.60	(19)	EECS	2.99	0.30	(74)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

STUDENT GPA

Introduction and Crossreferences. Student performance can be assessed in several ways. At this point, the report considers only their performance as measured by Grade-Point-Average (GPA). The reader is also referred to the items on student retention of material learned, the extent of program contribution to a thorough understanding of the subject matter, and the influence of the instructional process as a whole (see page references on page 34).

Grade-Point-Average at UCB. For all the respondents, the average GPA for all courses taken at Berkeley (i.e., not just those in the student's own program) was reported to be 3.04 [UMPEQ #13]. Across the 12 Engineering and Physical Science programs, GPAs ranged from 2.88 to 3.32, and there were significant differences between some of the program averages, with students in most of the larger departments (except EECS) as well as some of the smaller ones tending to report lower GPAs [F-prob.= .0000]. The highest GPAs were reported in Physics (3.32), Chemistry (3.22), EECS (3.19) and Math (3.18), and these were significantly higher than one or more of those reported in Geology (2.88), Materials Science (2.88), Civil Engineering (2.91), Mechanical Engineering (2.94), Chemical Engineering (2.96) and L&S Computer Science (2.98).

Item: Thus far, what is your Grade Point Average for all courses completed at Berkeley? [UMPEQ #13.] [1979 wording: includes words "you have" before "completed" and no underlining.]

TOTALS — Engineering and Physical Sciences

Mean: 3.04 ± 0.04 (546) F-probability = .0000

Prog.	Mean	95% Conf.	N								
Geol	2.88	± 0.20	(26)	*XsferE	2.93	± 0.24	(20)	IEOR	3.02	± 0.21	(21)
MSE+	2.88	0.14	(25)	MechE	2.94	0.11	(82)	NuclE+	3.07	0.23	(23)
CivilE	2.91	0.12	(74)	ChemE	2.96	0.13	(60)	*SocS79	3.17	0.04	(475)
*XsfLSC	2.92	0.22	(23)	LSComp	2.98	0.12	(54)	Math	3.18	0.15	(36)
EECS	3.19	± 0.12	(71)								
Chem	3.22	0.16	(34)								
Physic	3.32	0.13	(40)								

Because these data represent overall GPA at UCB, they are not directly usable in assessing grades awarded/earned solely within each program. With the large variety in patterns of course-taking and possible grading differences between programs, the data are also not very usable in assessing the overall GPA-earning ability or quality of each program's students.* In any case, since most studies have found little or no relation between GPA and subsequent success in life, however defined, it is a dubious practice generally to attribute much meaning to GPA, except to some extent as a predictor of GPA in subsequent schooling. Findings internal to this study (see below) again seem to reinforce this conclusion.

As we have found generally in other undergraduate program evaluations at Berkeley, the variable "GPA at UCB" has low to very low Pearson product-moment correlation coefficients with most other variables that might on a rational basis seem as though they should be related to it. By way of illustration from the Engineering and Physical Science Sample, the association was quite low between the respondents' GPA at UCB and items such as: "hours of study per unit per week" (in Fall 1979), with the Pearson correlation squared (r^2) equal to + 00%; and the student's rating of workload in their own program as contrasted with other programs (r^2= - 00%). The r^2 figure represents the percentage of each

*GPA within each student's program (which the ARU has at times requested instead) also proves not to be a very useful measure, since respondents have completed a varying number of, and sometimes relatively few, courses (in upper division). The data as collected, however, are somewhat useful in correlating UCB GPA with other item responses (see text).

item's variance that may be predicted from the variance in the other item. In the case of the first relationship cited above, this means that knowing how many hours per week per unit that each student studied during the (one) Fall Quarter will not in any way help you to predict the student's GPA at UCB.

Some additional correlations of GPA at UCB with other item ratings in the Engineering and Physical Science Sample are: the rigor of grading in the student's program (r^2= - 10%); the benefits of a competitive learning environment to the student (r^2= + 6%); the extent to which the student will long remember what he/she has learned in the program's courses (r^2= + 2%); the extent to which the student's overall growth and learning has been influenced by the instructional process (r^2= + 3%); and the student's overall satisfaction with his/her major program (r^2= + 5%). Although in this study we correlated reported GPA at UCB with only 30 other variables, the best predictors of a higher GPA (and they are not mutually exclusive) were the students' ratings of the ease of grading in their own program (10%), the students' capacity to benefit from competition (6%) and their overall satisfaction with their program (5%).

Summary of Problems and Findings by Program: Competition, Testing, Grading and GPA

In this summary, in contrast to the other summaries, the focus is not solely on "problem" areas, if only because it is not always clear when a problem may be said to exist (e.g., what level of grading rigor is too extreme?). The foregoing sections dealt with items concerned with: whether the level of competition at UCB helps students to study and learn and, in engineering, whether students choose humanities and social science, and technical, electives more for their moderate workloads and scheduling convenience than for gaining general or supporting knowledge and understanding; the caliber or motivation of the students' peers in the majors; the clarity of faculty expectations in coursework and grading; the accuracy of testing; the rigor of grading practices and, in engineering, the proportion of course grades that homework should account for; and overall GPA at UCB.

With the partial exception only of IEOR, none of the program faculties were rated as being particularly clear about what courses will cover and what students will need to know or do to get an "A" grade. But given the material ultimately presented in most of the courses, the tests were regarded by bare to very large majorities in all of the programs as being "fairly accurate" measures of the student's knowledge of the subject matter—but in no program did strong agreement exceed 11%. — All progs.

Grading was rated as rigorous in the extreme (i.e., an "A" grade being obtained only with great difficulty), and students' average GPAs at UCB were relatively low (2.88 to 2.98) in Chemical Engineering (especially), Geology, Civil Engineering, Mechanical Engineering and L&S Computer Science. Views were negative about the value of competition to students' efforts to study and learn in Geology, and were fairly evenly divided in L&S Computer Science, Mechanical Engineering and Chemical Engineering. Among the engineering departments (where the only inquiry was made), Chemical Engineering, Mechanical Engineering and, to a lesser extent, Civil Engineering students reported that their test results were too often unjustly influenced by time pressures, and Mechanical and Civil Engineering students usually felt that their homework should count for a higher proportion of their grade, with Chemical Engineering students more evenly divided on this score. — ChemE, Geol, CivilE, MechE, LSComp

Physic Chem EECS — Students in Physics, Chemistry and EECS also reported their grading to be very rigorous (but not so extremely), and their average GPAs at UCB were as high as any of the 12 programs (3.19 to 3.32). Views about the value of competition to student learning were fairly evenly divided in EECS and slightly more positive in Physics and Chemistry. On questions not asked in Physics and Chemistry, students in EECS tended to feel that time pressures on midterms unjustly influenced their grades and were a little more likely than not to want their homework counted more in the grading; they were also divided evenly on the question about whether faculty should use a more "absolute" approach to grading.

NuclE+ — Nuclear Engineering students reported extremely rigorous grading and middle level GPAs at UCB (3.07). They wanted somewhat more credit for their homework in course grading.

Math MSE+ — In Math and Materials Science, the grading was not as likely to be regarded as "very rigorous" and the caliber or motivation of the majors, though still rated as somewhat high, was lower (especially in Math) than in some other programs. The average GPAs at UCB for Math students (3.18) were among the high group, while those for Materials Science students (2.88) were among the lowest. The effects of competition on learning in Math were modestly positive at best. In Materials Science, on items unique to engineering departments, more students than not would welcome a little more credit for their homework in course grading and also felt that time pressures on midterms resulted in somewhat unjust grading.

IEOR — Grading in IEOR was seen as very (but not extremely) rigorous and average GPAs at UCB (3.02) were near the average for the group as a whole. The caliber or motivation of the majors, though still rated as somewhat high, was lower than in some programs.

STUDENT WORKLOAD

The Workload Question in its Broader Perspective

The regulations of the (faculty's) Academic Senate, which are applicable throughout the University System, state: "The value of a course in units shall be reckoned at the rate of one unit for three hours' work per week per term on the part of a student, or the equivalent" [Chapter 4, Article 1, Regulation #760, The Manual of the Academic Senate, University of California, page 41]. In practice on this campus, the Committee on Courses (of the "Berkeley Division" of the Academic Senate) has developed guidelines allowing the award of one unit of credit for each hour of lecture, one-half of a unit for each hour of discussion section, and one-third of a unit for each hour of laboratory. (The Committee typically rounds upward if the guidelines work out to a figure of, e.g., 3 1/2 or 3 2/3 units.) Although these guidelines are not (yet?) rigidly enforced in all course unit valuations throughout the campus, there have been unit reductions recently in some number of social science department courses (which will)

impact negatively on the FTEness problem described below). Ideally, whatever the department, if the Committee on Course's guidelines in some cases fail to result in a fair determination of the unit value(s) assigned to course(s), exceptions should be made either in the award of units to such courses or adjustments should be made in the amount of work assigned or expected by the instructor.

"FTEness" of Students. University funding from the State is based on the number of full-time-equivalent (or FTE) students. An FTE student is defined as one who takes 15 units per quarter (the official, full-time load). Thus, for example, if 15 students each take an average of 14 units per quarter during a particular year, together they enroll for 210 units per quarter (14 X 15= 210); but the 210 units must be divided by 15 (one full-time student's workload) in calculating University funding, and thus the number of FTE students is only 14 (210 ÷ 15= 14), rather than the 15 "headcount" students with which the example began. In recent years, the average number of units taken by the students at UCB has been dropping. In Fall 1975, the average student took 14.26 units per quarter; in Fall 1978, that average had dropped to 13.80.* And the average was even higher before Fall of 1975. Among the Engineering and Physical Science Sample respondents, 42.0% of the students reported taking 11-13 units in Fall of 1979, and another 5.7% took 10 or fewer units [UMPEO #9].

Reasons that Students Now Take Fewer Units. Various reasons have been advanced to explain why students are now taking fewer units. Among some of the most likely factors are: an increased need to work to pay for portions of one's education (e.g., 22.5% of the Engineering and Physical Science Sample worked 11 or more hours per week [UMPEO #10]); the increased pressure for students to get good grades so that they will have a better chance to get into graduate or professional school (e.g., particularly in the pre-medical/health areas); and, especially in disciplines where the workload is quite heavy, the desire to pursue an education, broadly defined, without taking on an extraordinary class-related workload.

Effects of Decline in Student FTEness. In order to maintain the current level of funding for the Berkeley campus as the average FTEness of each student has declined, the Administration has chosen to enroll more headcount students. The principle alternative to this strategy--a reduction in the number of faculty (and associated support funds)--would be likely to result in actions such as the elimination of experimental programs (especially at the undergraduate level) and/or the elimination of one or more whole departments and/or reductions in the number of faculty allocated to many of the regular departments. Any of these actions could subject the campus to considerable internal conflict. Other, longer-term components to a solution are also available for use, and a number of these are discussed in the next subsection (pages 49-56). But, for the moment, enrolling more students has put severe pressures on the availability of housing in Berkeley and the surrounding communities, with negative effects on students' educational opportunities (proximity to campus) and finances (rents, commuting costs), and on the community and University-community relationships. In addition, since most of the additional students have been taken on at the lower division level, the quality of education and of faculty-student contact has suffered from the overcrowding, especially since there appears to have been very little shift of faculty teaching resources toward lower division. Finally, the major programs of greatest interest are also becoming more crowded in terms of the total number of headcount students and course-takers.

*"Long-Range Academic Plan Statement, 1980-1985," University of California, Berkeley, Spring 1980, Appendix B, page 1.

ASSESSMENT OF STUDENT WORKLOAD

Introduction and Crossreferences. Across the entire Engineering and Physical Science Sample, workload was assessed in two ways: by direct student ratings of the amount of work in their program's courses in comparison to courses taken in other departments: and by dividing students' reports of the number of hours per week that they had studied by the number of units they reported taking (both for Fall 1979). In addition, students in four engineering departments were asked to fill in the appropriate number of units for the required courses in their major (for all courses they had taken), and these reports are compared with the actual unit values assigned to those courses. A related topic--the impact of competition and workload on students' choices of electives--is discussed on page 36 (for the engineering departments only).

While an analysis of student workload is included in all ARU survey evaluations, the FTEness situation described above, together with the reputation of the engineering and physical science programs as being high workload areas, suggested the need for especially close attention to the workload question in this evaluation. The Engineering Supplement also included a 9-point item to ask students what they would prefer to do if the unit values in 5 to 10 of their lower and upper division courses were (to be) raised, each by one unit. The responses to this item are discussed in the next subsection (pages 50-55). Also discussed in that subsection are the proposals to deal with the FTEness problem that were adopted by the Representative Assembly of the Berkeley Division of the Academic Senate, and by the Engineers Joint Council in a letter, which made suggestions based on the results of the 9-point item, to the Representative Assembly.

"Behavioral" Report of Student Workload. The estimate of workload based on student reports of their behaviors rather than student ratings was calculated by dividing students' reported estimate of: 1) the number of hours per week of study outside of class in Fall Quarter of 1979, by 2) the number of units taken in that same quarter. Please note that this measure assesses the workload in the student's entire set of courses in Fall, and is not restricted to courses offered by the program in which the student is majoring. Thus, insofar as courses outside Engineering and the Physical Sciences require less work, these data understate the workload per unit in engineering and physical science courses. Unfortunately, the ARU has no strictly viable comparison data from other departments on this measure, because of a modification of the item on hours of study per week. Since previous versions of this item did not include sufficient explanation, students in Engineering and Physical Sciences were also told: "Please include time spent in serious discussion about course materials and study sessions with peers; writing and reading for papers and reports; doing problem sets; overtime spent in lab; etc." But, based on the earlier, less complete item, the mean hours of study per unit per week outside of class for any single program thus far evaluated by the ARU has never exceeded 1.91 (Chemistry, 1977) and has been as low as about 1.00 in disciplines where the additional explanation would be likely to have produced a higher and fairer estimate.

Across the entire Engineering and Physical Sciences Sample, for all courses taken in Fall 1979, the calculated mean "number of hours of study per unit per week (outside of class and lab)," was 2.07. In terms of the official Academic Senate formula (above, page 42), which requires three hours of student effort per unit per week (including class time), this average is above expectations, especially insofar as the weekly number of hours of class and lab exceeds the course unit values actually awarded.*

*See footnote on next page.

Differences between programs for these calculations of "hours of study per unit per week (outside of class and lab)" were of borderline significance at most [F-prob.= .0859]. However, the confidence interval for the mean reported workload in IEOR (1.54) did not overlap with those for Chemical Engineering (2.39), Physics (2.26) and Mechanical Engineering (2.19). Hours of study per unit per week were also above the required 2.00 in Materials Science (2.09), Chemistry (2.09), L&S Computer Science (2.08) and EECS (2.06), and not much below that in Civil Engineering (1.93), Nuclear Engineering (1.91), Math (1.83) and Geology (1.80). As suggested above (and illustrated in footnote *), laboratory courses in many of these programs imply that the average total hours of work per unit per week (including class time) is above 3 hours in these departments' courses.

Item: Hours of study outside-of-class, per unit per week, for Fall 1979. The figures presented below are based on a recoding of the two questions shown below (see *** for recoding) and the division of the latter (hours per week of study outside of class) by the former (number of units).

How many units did you take in Fall 1979? [UMPEQ Q9.]

During Fall Quarter 1979, about how many hours per week did you study outside of class and lab? (Please include time spent in serious discussions about course materials and study sessions with peers; writing and reading for papers and reports; doing problem sets; overtime spent in Lab; etc.) [UMPEQ Q11.]

Prog.	Mean*** Recd.	95% Conf.	N	Prog.	Mean*** Recd.	95% Conf.	N
IEOR	1.54	± 0.29	(20)	Math	1.83	± 0.31	(37)
Geol	1.80	0.39	(24)	NuclE+	1.91	0.33	(24)
*MatLSC	1.80	0.38	(24)	CivilE	1.93	0.20	(72)

TOTALS — Engineering and Physical Sciences

Recoded Mean: 2.07 ± 0.09 (330) F-prob. = .0859

Prog.	Mean*** Recd.	95% Conf.	N	Prog.	Mean*** Recd.	95% Conf.	N
EECS	2.06	± 0.27	(74)	MechE	2.19	± 0.22	(85)
LSComp	2.08	0.29	(51)	Physic	2.26	0.35	(40)
Chem	2.09	0.37	(37)	ChemE	2.39	0.27	(61)
MSE+	2.09	0.48	(25)	*MatsE	2.52	2.53	(32)

***The grand mean, program means and F-probability are based on the quotients resulting from the division of the recodes for Question 11 by the recodes for Question 9. The original codes and their recoded values are as follows: Question 9-- 1-3 [units]= 03; 4-10= 08; 11-13= 12; 14-16= 15; 17-19= 18; 20-22= 21; and 23 or more units= 24; Question 11-- 00 [hours per week studied outside of class]= 00; 1-3= 03; 4-10= 08; 11-15= 13; 16-20= 18; 21-25= 23; 26-30= 28; 31-35= 33; 36-40= 38; 41-50= 45; 51-60= 55; 61+ hours per week= 65.

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

Workload Ratings. When asked whether "compared to work in other programs, the students in this program must do a lot of work for the number of units (credit) awarded," an overwhelming majority of the respondents agreed, a large majority strongly so (S.D. 1-5/8/24-63% S.A.)** [UMPEQ #29]. Every Engineering and Physical Science program was rated as having a higher workload than was found in the average of all the Social Science-related programs, all but one was rated as higher than the average for the Selected Humanities, and all but two were rated as having a greater workload per unit than was reflected in the mean rating for the Health-related Sciences Sample. The mean rating for Engineering and the Physical Sciences as a whole was 0.44 scale points above that for the Health-related

*For example, Mechanical Engineering 102A consists of three hours of lecture and three hours of laboratory per week, for which 4 units are awarded. For the student taking 15 units and one such course (i.e., conservatively assuming all other courses had classtime hours equal to the units awarded), who otherwise studied for 2.07 hours per unit per week outside of class, the total time required per unit can be calculated as follows: 17 hours (class + lab) plus 31.05 hours of study (= 2.07 X 15 units) equals 48.05 hours. That number of hours, when divided by the unit load (15), equals 3.20, the number of hours per unit per week of total time spent in class and lab and in study for that student's classes.

**The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

Sciences, 0.98 above the Selected Humanities, and a "large" 1.50 points above the Social Sciences Sample.

Item: Compared to work in other programs, the students in this program must do a lot of work for the number of units (credit) awarded. [UMPEQ Q29].

TOTALS — Engineering and Physical Sciences

1% Str. Disagree, 5% Disagree, 8% In Between, 63% Str. Agree, 24% Agree

Mean: 4.43 ± 0.07 (549) F-probability = .0000

Prog.	Mean	95% Conf.	N
*SocS79	2.93	± 0.09	(442)
Math	3.32	0.36	(37)
*SHum77	3.45	0.14	(250)
MSE+	3.71	0.38	(24)
IEOR	3.74	± 0.43	(19)
*HlcS77	3.99	0.10	(417)
Geol	4.24	0.36	(23)
Chem	4.39	0.36	(33)
Physic	4.40	± 0.31	(40)
EECS	4.49	0.19	(72)
*EsfLSC	4.57	0.31	(23)
NuclE+	4.65	0.28	(23)
MechE	4.66	± 0.16	(87)
ChemE	4.67	0.16	(61)
CivilE	4.68	0.13	(75)
*EsfarE	4.68	0.21	(22)
LSComp	4.77	0.22	(53)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Despite the nearly unanimous agreement (87%) across the Engineering and Physical Sciences Sample that workload was comparatively high, there were statistically significant differences between some of the program ratings [F-prob.= .0000]. There was a whole group of programs with very-high workload ratings, with agreement at the overwhelming level (and strong agreement ranging from large to very large majorities). Within this very-high workload group, the highest-ranked ratings were given to L&S Computer Science (S.D. 0-0/0/23-77% S.A.), but ratings suggestive of workloads of virtually equal magnitude were also found for Civil Engineering (0-3/3/19-76), Chemical Engineering (0-2/3/21-74), Mechanical Engineering (1-2/2/18-76), Nuclear Engineering (0-0/9/17-74), EECS (0-4/7/25-64), Physics (3-5/5/25-63) and Chemistry (3-3/12/15-67). At the lower end of the rankings, with mean ratings significantly lower than all of these programs (and also below Geology), was Math, where "only" a plurality agreed (0-30/24/30-16) that the workload was comparatively high. In a tier above Math, with a majority or large majority agreeing, but still significantly below all but two of the programs in the very-high workload group, were Materials Science (0-13/21/50-17) and IEOR (0-5/42/26-26). Geology (0-8/4/44-44) fell more toward the very-high workload group than not, but its ratings were still significantly lower than those of L&S Computer Science.

Comparison of Rated and Reported Workloads. Since the behavioral reports of student workload (i.e., involving the measure "hours of study per unit per week, outside of class and lab") are based on the respondents' memories and represent an estimate (of hours of study per week) across 10-11 weeks of the quarter, the data should not be seen as precise (although the estimate may well be fairly accurate since the student is doing much the same thing two to four months later). Concerning the rating of student workload, the differences in the program means would seem to be attributable both to different workloads within the major and to the different patterns of coursework outside the major (where the latter comprise the basis of comparison for each student's assessment of his/her own program's course workloads). These factors, as well as the facts that the reported workload is an assessment only for one quarter and includes some unknown number of courses taken outside the major programs (where that number may vary by program), preclude the development of any expectation that the two workload measures will be perfectly correlated.

Nevertheless, as one way of estimating the correspondence between the two measures, the Pearson product-moment correlation coefficient for the 12 program means on the two items was calculated. This correlation came out to be 0.52. A correlation coefficient of 0.52 indicates that 27% (0.52^2) of the variation in program means (with respect to the grand mean for one of the items) could have been predicted with the knowledge of the results on the other item (and of the

correlation coefficient). Although this correlation coefficient is based on an "N" of only 12 (programs) and would have a fairly wide confidence interval, these results nevertheless suggest the general validity of the measures, especially in view of the reasons for expecting a less-than-perfect correlation. For another look at the correspondence between the two items, see this footnote.*

Workload in Individual Courses. *For four programs in engineering--Civil, Mechanical, Materials Science and Chemical--the evaluation included student assessments of the unit values appropriate for each of their required upper division courses. The results of these ratings are summarized in the table below and are reported in full in Appendix B.*

Percentage of Required Courses with Unit Values Which Are Over, Appropriately, and Under-valued

	Students' Mean Rating** of the Appropriate Number of Units (Minus) the Actual Unit Value								Totals for Departmental Courses Only		
	Over-valued	Appro-priately Valued		Under-valued							
Department (& No. of Courses)	-.34 or less	-.33 to .00	.00 to +.33	+.34 to +.50	+.50 to +.67	+.67 to +.83	+.83 to +1.00	+1.00 or more	Average No. of Units Awarded, Actual	Average Rating, Approp. No. of Units	(N)
Civil E. (15)	7%	17%	43%*	33%	--	--	--	--	3.50	3.66	(14)
Mech. E. (15)	7%	30%	30%*	7%	27%**	--	--	--	3.67	3.94	(12)
M.S.E. (12)	--	21%*	29%	13%	29%**	--	--	8%	2.67	3.01	(9)
Chem. E. (17)[a]	--	18%*	29%**	24%**	18%*	6%	--	6%*	3.80	4.10	(10)

*The number of asterisks affixed to the percentages in the table indicate the number of rated courses that are offered by departments other than that in which the respondent is majoring. (See also footnote "a".)

**The students were asked to fill in the appropriate number of units for each of the courses which they had actually taken. Courses with mean ratings which fell exactly at the assigned unit value, or 0.50 units above that value, were counted as half a course in each of the two adjacent intervals (e.g., "-.33 to .00" and ".00 to +.33"). Courses are included in this table if they were included in the questionnaire and had seven or more raters. Of 47 C.E., M.E. and Chem. E. courses, only two had 12 or fewer raters.

[a]The 17 course ratings by Chemical Engineering students include separate entries for Chemistry 111A (new), Chemistry 111A and 111B (both old), and two for the student's introductory course in computer science, one if the course was self-paced, the other if not. (The introductory computer science course could have been in either upper or lower division.)

*Since there is actually very little variation among 8 (of 12) of the rated workload means, and even less among 11 of the reported means, the observed correlation (0.52) may well be artificially depressed (e.g., were the sample instead to include all undergraduate programs at UCB). Examined another way, if one considers the 7 programs with reported workloads that are higher than 2.00 hours of study per unit per week outside of class and lab, and looks at the extent to which the same programs occur among those 8 departments with ratings suggestive of a very-high workload, one finds that 6 out of the 7 (or 86%) do.

In summary of the majors' assessments of the appropriate unit values for their required upper division coursework, the following statements can be made:

1) *The workload per unit is too high in all four departments, especially in Materials Science and Chemical Engineering, and somewhat less so in Mechanical Engineering and Civil Engineering.*

2) *If one regards undervaluation of courses by 0.50 units or more as a serious problem, the percentages of required departmental courses (i.e., apart from courses required in other departments) which need substantial attention are: Materials Science 33% (3 of 9), Chemical Engineering 30% (3 of 10), Mechanical Engineering 17% (2 of 12), and Civil Engineering 0% (0 of 14). In addition, several of the Materials Science courses for which there were six or fewer raters (i.e., which were excluded from consideration in the table) received ratings of the "appropriate number of units" which were also suggestive of serious undervaluation.*

3) *If one regards undervaluation of courses by 0.34 units or more as significant, the percentages of required departmental courses which need some attention are: Chemical Engineering 50% (5 of 10), Materials Science 44% (4 of 9), Civil Engineering 36% (5 of 14), and Mechanical Engineering 25% (3 of 12).*

Summary of Problems by Program: Student Workload

Student workload was assessed by students' ratings of the workload in their program's courses (asked in comparison to those they've taken in other departments), with reported or "behavioral" measure of "hours of study per unit per week (outside of class and lab), for Fall 1979" (only), and, in four engineering departments, by comparison of the actual unit values of courses required by and within the major department with filled-in ratings by the respondents of the appropriate number of units for each of the courses they had taken.

Broader Context. In the Engineering and Physical Science Sample, students' mean ratings of program workload were higher, usually much higher, than those observed in the Social Science-related, Selected Humanities, and Health-related Science Samples.* The reported measure of student workload, which suggests workload is too high but not extremely high, represents an underestimate in assessing total workload within the programs of students in the Engineering and Physical Sciences. In many programs, for example, extensive time is spent in required labs, such that there are more hours of class and lab than there are units awarded. Moreover, the reported measure is further an underestimate in that it includes lighter workloads in (elective) courses taken in departments as far removed as the humanities and social sciences. In addition, a large minority of the Engineering and Physical Science respondents chose their humanities and social science courses more for reasons of moderate workload or scheduling convenience than for general or supporting knowledge or understanding (i.e., some chose "easy" courses outside the major program to compensate for the high workload in their program's courses). (See page 36.) Thus reported workload is lower than it would be if the measure excluded "easier" courses in lower-workload departments and would be an underestimate of course workloads typical in the major program--to which must be added also the extra lab hours noted above (see also footnote *, page 45).

*Students' mean ratings of this item, for almost all 47 programs thus far evaluated by the ARU, are above the midpoint of the 1-5 scale. In part, this is probably because students typically take many courses in other departments which are introductory in nature and/or designed for nonmajors.

As assessed by two different measures, the highest student workloads were found in Chemical Engineering, Physics, Mechanical Engineering and L&S Computer Science, with workloads no more than marginally lower in EECS and Chemistry, and with Civil Engineering and Nuclear Engineering also nearly as high. In all of these programs, and possibly also in Geology, workload probably exceeds the level of work per unit of coursework established in the Academic Senate's regulations (especially after lab times are included properly in the consideration. *As further evidence, supplementary assessments by majors of the appropriate number of units for award to individual required courses within three of these departments showed 30-50% of Chemical Engineering courses undervalued to a meaningful degree, as well as 17-25% of Mechanical Engineering and 0-36% of Civil Engineering courses (and only 0-7% of these departments' courses seem to be overvalued).* ChemE Physic MechE LSComp EECS Chem CivilE NuclE+ Geol

The workload ratings for Materials Science were fairly high, but were clearly more modest than in the programs noted above. But the calculation for hours of study outside of class and lab was among the higher figures reported, *and 33-44% of the individual courses within the Materials Science Department were assessed as undervalued to a meaningful extent in the number of units awarded.* MSE+

The workload ratings for IEOR were also fairly high, but again comparatively moderate; in Math, the ratings were moderately high at most. But Math students reported a more intermediate number of hours of study outside of class and lab, while the same reports for IEOR were not particularly high, at least when regarded comparatively. IEOR Math

POSSIBLE SOLUTIONS TO THE FTENESS AND PROGRAM WORKLOAD PROBLEMS

This section deals with possible solutions to the FTEness and workload problems. Foci include an account of actions recently taken by the Representative Assembly of the Berkeley Division of the Academic Senate and a nine-point item which allowed students in the Engineering Departments to express their priorities for action.

Faculty Senate Action Taken

Because of the University's FTEness and funding problems (see above, pages 42-43), which are being exacerbated further by State-mandated changes in the accounting of graduate student FTE, the Berkeley Division (with Administrative urging) has begun to take action. With reference to undergraduate education, the Representative Assembly adopted the following principles and regulation:

Undergraduate Programs*

1. The baccalaureate at Berkeley [should] continue to be a four-year degree and that the units required for the degree [should] reflect accurately the amount of work and instruction involved. One hundred eighty (180) units should be the minimum, rather than the standard, for that degree.

*Minutes of the Representative Assembly, June 3, 1980, pages ix-x. The actual wording of Regulation A240.1 and A240.2 have been substituted here for principles 2.a and 2.b. A240.1 is new; A240.2 was already on the books.

2. Unless the Dean of the School or College in which the student is enrolled approves a variance because of exceptional circumstances:
   a. [Regulation A240.1*] A student's transcript, at the end of every three regular Quarters (Fall, Winter, or Spring) of enrollment on the Berkeley Campus, and regardless of whether these Quarters are taken consecutively, shall aggregate a minimum of 39 units of work completed on a campus of the University in those Quarters, regardless of grade.
   b. [Regulation A240.2*] A student's final study list shall contain at least 12 of units of credit in any Quarter.**
3. Schools and Colleges [should] enforce these two provisions through procedures commensurate with those for substandard academic performance (e.g., warning letters: the blocking of enrollment until a plan to remedy deficiencies is approved).
4. Student credit hours for Mathematics P, Subject A, and similar preparatory courses [should] be increased to reflect accurately the amount of work and instruction these entail. Graduation requirements should be increased for students taking these preparatory courses by the unit credit given for these courses.
5. The system of course planning, advising, assignment, and pre-enrollment [should] be strengthened to minimize students' need to enroll for additional quarters to obtain the courses they require and, specifically, that a campus-wide system of advanced scheduling and enrollment be instituted.*

Of these principles, only A240.1 (#2.a, above) and A240.2 thus far have the force of law within the University. Starting in the Fall Quarter of 1981 (i.e., as of Spring 1982), each student, unless he/she has an approved variance, will be required to have completed 39 units for the previous three quarters at UCB (or other U.C. campus). While full-time students may still take 12 units in one (or two) quarters, they will now have to compensate by taking at least 14 units (or 15 units) during some other quarter(s) of the year. Since 42.0% of the Engineering and Physical Science students took 11-13 units (with most presumably taking 12 or 13) and 5.7% took 10 or fewer units, the new regulation (A240.1) may have a significant affect on a large minority of Engineering and Physical Science students. Thus far, it remains to be seen whether all the pressure will be placed upon students or whether the other principles will in fact be acted upon. For example, "strengthened" advising may prove to be little more than a policing of A240.1 and better course planning and assignment may mean simply that students will have to proceed in lock-step at the same pace; the raising of the 180 unit ceiling for the bachelor's degree may apply only to those courses cited in Principle #4: the element of Principle #1 which calls for units required for the degree to "reflect accurately the amount of work and instruction involved" may continue to be benignly neglected.

Student-preferred Solutions to Program Workload Problems

Based on the survey results which are presented in this subsection, and in response to the proposal to adopt and enact the principles and legislation cited above, the Engineers Joint Council on May 27, 1980 adopted plans for distributing a letter of comment on the proposals to faculty members attending the June 3, 1980 meeting of the Representative Assembly. This letter is included as Appendix E. While it is not known if the letter had any effect, one change or clarification made in the initial proposal by its proponents was to have Regulation A240.1 (39 units per year requirement) take effect as of Fall 1981 (rather than Fall 1980).

See footnote "" on previous page.

**Exceptions would presumably be made for students who received formal permission to enroll on a part-time basis.

Implementation of A240.1 only as of Fall-Winter-Spring 1981-82 allows at least some time for a proper evaluation of course unit values to ensure that they are in conformance with Senate Regulation #760 (see page 42) and Principle #1 above, which indicates that "the units required for the degree [should] reflect accurately the amount of work and instruction involved."

With the use of two or three different measures, depending on the program, it was already established that student workloads in most Engineering and Physical Science programs are too high (see above, pages 44-49). Since it was surmised initially that workload might be a problem in many of these programs, the Engineering Supplement included a nine-point item to ask what students would do to remedy the situation. Ultimately, any change must involve individual courses, since there are only two ways (or combinations thereof) by which a fair assignment of units can be made--by adjusting course workload and/or the number of units awarded. However, across an entire program, various approaches can be taken. Hence, in their consideration of the workload question, program faculties, in conjunction with the majors, should consider the solutions preferred by respondents from the program (see the summary, page 55). However, it would seem appropriate for the Divisional Committee on Courses to ensure that a full review is conducted in programs identified as having very high workloads, with a view toward achieving equity in course unit values, by some combination of adjusting workload levels and unit values, as proposed by the programs.

Among the engineering departments, students were asked to give their views of nine possible ways of dealing with the impact on their program of courses where the number of units awarded were too few in comparison to the actual student workload [ESQ #32A-I]. The students were asked to assume that the unit value for 5-10 of the courses in their lower and upper division program was determined to be too low (e.g., by one unit each) and that plans were being made to raise them, and then to rate the desirability of the nine ways of adjusting their programs. (Some of the nine alternatives also involved reductions in the workload of these courses, so that, for courses such as these among the 5-10, it would no longer be necessary to raise their unit values.) For this item, the following scale was used:

1= Do not use at all
2= Use a little
3= Use some
4= Use much
5= Use as much as possible.

The discussion in the text proceeds from the least to the more accepted alternatives. A very large majority of the respondents, or nearly so, favored little or no use (responses "1" + "2") of three of the nine possible ways of adjusting their program's workload, and only about 10% favored much use of them (responses "4" + "5"). While one method of adjustment was actually rejected by a bare majority of the respondents, with 51% marking "do not use at all," the mean rating was almost equivalent of "use a little" for all three of these least-favored ways of programmatic adjustment.* The three least-favored ways were:

B. Lower the number of free electives (1= 51-20-19-9-1% =5):
D. Lower the number of units in technical electives (1= 45-25-21-6-3% =5);
E. Lower the number of upper division courses required in the major (1= 44-27-18-7-4% =5).

*In the preliminary version of the tables (pages 53-54), an ARU assistant typed in the confidence interval values in a way such that the intervals represented the full 95% range of the mean rather than only half of that range, as implied by the "±" symbol. These tables have now been corrected.

For all three of these items, there were no statistically significant differences between program ratings and at least 60% of the respondents in each program chose response categories "1" and "2" ('little or no use'). The program means and F-probabilities are shown in the tables on the two pages following.

Four other ways of adjusting their programs in response to an increase in the unit value of 5-10 of the required courses in lower or upper division received mean ratings indicating that students would be acceptant of at least a little adjustment of their courses or program by such means. Overall, 50-60% of the respondents wanted little or no use (responses "1" + "2"); much use (responses "4" + "5") was favored by a minority of 14-27%, but at least some use was supported by 40-50%. These four items were:

F. Reduce the extent of lab work in required courses (1= 36-24-24-11-5% =5);
H. Reduce the breadth/depth of coverage in courses required but of lower priority to the program (1= 25-27-33-9-5% =5):
G. Reduce the homework in required courses where it is unnecessarily detailed (1= 26-24-29-16-5% =5);
C. Lower the number of required course units in the humanities and social sciences (1= 33-21-20-16-11% =5).

There were few or no real differences of consequence in the program-by-program ratings of the items about reductions in labwork (Item F), breadth and/or depth of coverage in required courses (Item H) and homework in required courses (Item G). Examining the range of responses by program, the minimum number of students favoring little or no use (responses "1" + "2") was 45-48% for these three items, while the maximum favoring little/no use was 62-73%. See page 55 for another item on the importance of the homework to the learning experience.

However, there was more variation between the program responses when it came to the question of whether to lower the number of required courses in the humanities and social sciences [F-prob.= .0225]. In all but two instances, at least 55% of the respondents favored little or no use (responses "1" + "2") of reductions in the number of required units in the humanities and social sciences; but in Nuclear Engineering, a majority actually responded "use much" or "use as much as possible" (1= 19-19-5-24-33% =5), whereas no more than 28% of the respondents in the other six programs did so. Responses in Materials Science (1= 46-17-21-13-4% =5) and Chemical Engineering (1= 45-18-20-12-6% =5) were most different from those in Nuclear Engineering, while EECS (1= 23-21-30-17-10% =5) was a distant second-high.

The second-most favored option to adjust programs in compensation for raises in the number of units of 5-10 undervalued courses was to cancel plans to increase the number of units in those undervalued courses or, in the words of the item, to "leave things as they are (i.e., even with units too low in some courses)."

I. Leave things as they are (1= 27-17-25-17-14% =5).

There were no significant differences between program ratings on this item. Among the seven programs, the range of 'use much' responses ("4" + "5") was from 24-47%, while the range of responses urging little or no use ("1" + "2") was from 37-52%. The 'much use' responses exceeded the 'little or no use' responses only in the three smallest engineering departments (IEOR, Nuclear Engineering, Materials Science).

Finally, for the engineering programs as a whole, the most acceptable way of adjusting their programs, if the unit values of 5-10 of their courses were to be raised to a more appropriate level, was to require more than 180 units to obtain the B.S. degree. The overall response had a mean rating equivalent to response category "3" ("use some"). In this case, a narrow plurality of 40% favored much use (responses "4" + "5"), as contrasted with little or no use (responses "1" + "2"), at 37%.

Item: Assuming the unit value for 5 to 10 of the courses in your entire lower and upper division program were determined to be too low (e.g. by one unit each) and that plans were being made to raise them, please rate the desireability of using each of the following means of programmatic adjustment. [ES Q32].

In all cases below, assume the continuation of the current policy allowing students to take up to 15 units more than the minimum required to graduate. (In cases F, G and H, some of the 5-10 upward unit adjustments might be cancelled out—to the extent they were chosen for reduction in workload.)

32A. Require more than 180 units to obtain the B.S. degree. (Program completion time may extend beyond four years for more students.)

TOTALS — Engineering

23% Do Not Use At All | 23% Use Some | 18% Use As Much As Possible

14% Use a Little | 22% Use Much

Mean: 2.97 ± 0.15 (325) | F-probability = .0001

Prog.*	Mean	95% Conf.	N							
IEOR	2.20	± 0.67	(29)	MechE	2.89	± 0.33	(79)	ChemE	3.35	± 0.41 (49)
IECS	2.46	0.31	(70)	NuclE+	3.10	0.66	(21)	MSE+	3.36	0.48 (22)

CivilE	3.39	± 0.31	(67)							
*XsferE	3.58		(19)							

32B. Lower the number of free elective course units in the program.

TOTALS — Engineering

51% Do Not Use At All | 19% Use Some | 1% Use As Much As Possible

20% Use a Little | 9% Use Much

Mean: 1.89 ± 0.12 (333) | F-probability = .4827

Prog.*	Mean	95% Conf.	N							
NuclE+	1.71	± 0.41	(21)	MechE	1.78	± 0.24	(79)	CivilE	1.93	± 0.26 (69)
ChemE	1.78	0.31	(50)	MSE+	1.83	0.53	(23)	IEOR	1.95	0.36 (20)

*XsferE	2.10	±	(21)							
IECS	2.13	0.25	(71)							

32C. Lower the number of required course units in the humanities and social sciences.

TOTALS — Engineering

33% Do Not Use At All | 20% Use Some | 11% Use As Much As Possible

21% Use a Little | 16% Use Much

Mean: 2.51 ± 0.15 (335) | F-probability = .0225

Prog.*	Mean	95% Conf.	N							
MSE+	2.13	± 0.53	(24)	*XsferE	2.29	±	(21)	MechE	2.48	± 0.31 (80)
ChemE	2.16	0.36	(51)	IEOR	2.37	0.70	(19)	CivilE	2.52	0.33 (69)

IECS	2.70	± 0.30	(71)							
NuclE+	3.33	0.72	(21)							

32D. Lower the number of units in technical electives (i.e., electives in your own or other engineering departments, physical sciences, math, statistics).

TOTALS — Engineering

45% Do Not Use At All | 21% Use Some | 3% Use As Much As Possible

25% Use a Little | 6% Use Much

Mean: 1.98 ± 0.12 (335) | F-probability = .3290

Prog.*	Mean	95% Conf.	N							
NuclE+	1.81	± 0.42	(21)	ChemE	1.85	± 0.31	(52)	IECS	2.11	± 0.25 (70)
MechE	1.31	0.22	(81)	MSE+	1.87	0.48	(23)	CivilE	2.14	0.25 (69)

IEOR	2.21	± 0.55	(19)							
*XsferE	2.24		(21)							

32E. Lower the number of courses (or total units) required within the upper division program in my major.

TOTALS — Engineering

44% Do Not Use At All | 13% Use Some | 4% Use As Much As Possible

27% Use a Little | 7% Use Much

Mean: 1.99 ± 0.12 (335) | F-probability = .5356

Prog.*	Mean	95% Conf.	N							
NuclE+	1.67	± 0.39	(21)	IEOR	1.89	± 0.58	(19)	MechE	2.00	± 0.24 (80)
IECS	1.89	0.26	(71)	ChemE	1.96	0.32	(52)	*XsferE	2.00	(21)

CivilE	2.10	± 0.27	(69)							
MSE+	2.30	0.57	(23)							

*The totals and F-probability exclude the "XsferE" sample, and are based on the original metric, i.e., 1= Do Not Use at All, 2= Use a Little, 3= Use Some, 4= Use Much, and 5= Use As Much As Possible. See Appendix A, p. A-11, for more information on the samples and on reading the tables.

Item: Assuming the unit value for 5 to 10 of the courses in your entire lower and upper division program were determined to be too low (e.g. by one unit each) and that plans were being made to raise them, please rate the desirability of using each of the following means of programmatic adjustment. [ES Q32, Continued].

In all cases below, assume the continuation of the current policy allowing students to take up to 15 units more than the minimum required to graduate. (In cases F, G and H, some of the 5-10 upward unit adjustments might be cancelled out--to the extent they were chosen for reduction in workload.)

32F. Reduce the extent of laboratory work in required courses (lower or upper division), adjusting unit values as appropriate.

TOTALS — Engineering

16% Do Not Use At All | 24% Use Some | 5% Use As Much As Possible
24% Use a Little | 11% Use Much
Mean: 2.26 ± 0.13 (333) | F-probability = .3000

Prog.*	Mean	95% Conf.	N						
NuclE+	1.95	± 0.51	(21)	IEOR	2.06	± 0.52	(18)	MSE+	2.26	± 0.49	(23)	MechE	2.42	± 0.31	(78)
EECS	2.04	0.26	(72)	*Xsferf	2.25		(20)	CivilE	2.29	0.25	(69)	ChemE	2.46	0.36	(52)

32G. Reduce the homework in required courses where it is unnecessarily detailed (lower or upper division), adjusting unit values as appropriate.

TOTALS — Engineering

26% Do Not Use At All | 29% Use Some | 5% Use As Much As Possible
24% Use a Little | 16% Use Much
Mean: 2.51 ± 0.13 (333) | F-probability = .7006

Prog.*	Mean	95% Conf.	N						
NuclE+	2.14	± 0.36	(21)	MSE+	2.43	± 0.48	(23)	ChemE	2.54	± 0.34	(52)	EECS	2.65	± 0.30	(71)
CivilE	2.43	0.26	(68)	IEOR	2.45	0.56	(20)	MechE	2.59	0.27	(78)	*Xsferf	2.79		(19)

32H. Reduce the breadth and/or depth of coverage in areas of coursework currently required but of low priority to the program, adjusting unit values as appropriate. [H. is intra-course, I. is inter-course].

TOTALS — Engineering

25% Do Not Use At All | 33% Use Some | 5% Use As Much As Possible
27% Use a Little | 9% Use Much
Mean: 2.42 ± 0.12 (320) | F-probability = .7227

Prog.*	Mean	95% Conf.	N						
MSE+	2.09	± 0.30	(22)	NuclE+	2.30	± 0.55	(20)	EECS	2.37	± 0.25	(67)	ChemE	2.48	± 0.34	(50)
IEOR	2.28	0.63	(18)	*Xsferf	2.32		(19)	MechE	2.47	0.24	(75)	CivilE	2.54	0.30	(68)

32I. Leave things as they are (i.e., even with units too low in some courses).

TOTALS — Engineering

27% Do Not Use At All | 25% Use Some | 14% Use As Much As Possible
17% Use a Little | 17% Use Much
Mean: 2.73 ± 0.15 (319) | F-probability = .2524

Prog.*	Mean	95% Conf.	N						
*Xsferf	2.30	±	(20)	ChemE	2.54	± 0.39	(50)	EECS	2.83	± 0.32	(69)	NuclE+	3.10	± 0.67	(21)
MechE	2.52	0.31	(71)	CivilE	2.56	0.34	(67)	MSE+	3.09	0.67	(22)	IEOR	3.15	0.74	(19)

*The Totals and F-probability exclude the "Xsferf" sample and are based on the original metric, i.e., 1= Do Not Use at All, 2= Use a Little, 3= Use Some, 4= Use Much, and 5= Use As Much As Possible. See Appendix A, page A-11, for more information on the samples and on reading the tables.

A. Require more than 180 units for the B.S. degree (1= 23-14-23-22-18% =5).

However, with regard to the acceptability of requiring more than 180 units for the B.S. degree, there were statistically significant differences between the ratings for some of the programs [F-prob.= .0001]. A majority, or very nearly so, favored much use (responses "4" + "5") of this option in Civil Engineering (1= 13-7-30-25-24% =5), Materials Science (1= 5-18-27-36-14% =5), Chemical Engineering (1= 18-8-18-31-24% =5) and even Nuclear Engineering (1= 24-10-14-38-14% =5). The first three departments mentioned had significantly higher ratings given to the acceptability of requiring more than 180 units for the B.S. than did students in IEOR (1= 45-20-20-0-15% =5) and EECS (1= 30-24-26-10-10% =5), where a majority to large majority favored little or no use.

The Homework Workload. The results noted above about homework (Item G) tended to be confirmed when students were asked whether in most of their program's courses they could learn the subject matter just as well without as much homework [ESO #19]. Overall, a very large majority of the engineering students disagreed (S.D. 24-48/16/8-4% S.A.).* While there was some indication that there were statistically significant differences within the seven mean ratings [F-prob.= .0372], the confidence intervals for all of the programs overlapped. Disagreement that the homework in most courses was somewhat superfluous seemed highest in Civil Engineering (32-47/15/4-1) and Mechanical Engineering (29-49/13/7-1) and least strong, though still by large majority, in Chemical Engineering (21-45/11/11-11).

Item: In most of my program's courses, I could learn the subject matter just as well without as much homework. [ES Q19].

TOTALS — Engineering

2% Str. Disagree, 48% Disagree, 16% In Between, 4% Str. Agree, 8% Agree

Mean: 2.20 ± 0.11 (347) F-probability = .0372

Prog.	Mean	95% Conf.	N									
CivilE	1.96	± 0.21	(72)	IEOR	2.15	± 0.41	(20)	MSE+	2.25	± 0.36	(24)	NuclE+	2.45	± 0.51	(22)
MechE	2.02	0.20	(82)	*NsfarE	2.18		(22)	EECS	2.35	0.25	(74)	ChemE	2.47	0.35	(53)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Summary of Preferred Solutions by Program: Workload Problem

This section dealt with solutions proposed to deal with the very high workloads found in some of the engineering departments. (A discussion of actions by the Berkeley Division of the Academic Senate was included prior to the presentation of results from the survey evaluation.) The students were asked to assume that the unit values for 5-10 of the courses in their lower and upper division courses were determined to be too low (e.g., by one unit each) and that plans were being made to raise them. Respondents then rated the desirability of nine possible ways of adjusting their program. In addition, the engineering students were asked if they could learn the subject matter in most of their courses just as well without as much homework (where a reduction in homework in some courses was also one of the nine possible ways of program adjustments).

*The figures in parentheses (under "The Homework Workload") represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.). (The other sets of parenthesized percentages represent the 1-5 scale shown on page 51.)

CivilE, ChemE, MSE+, MechE — For students in Civil Engineering, Chemical Engineering and Materials Science, and also in Mechanical Engineering (where none of the nine options was very highly regarded), the most preferred way of adjusting their program was to require more than 180 units for the B.S. degree. (The M.E. student response here was: 1= 28-13/20/22-18%, or 40% favoring much use, 60% some.) Materials Science students chose "leaving things as they are" as a fairly close second choice. Second priorities for action in Civil Engineering and Chemical Engineering were rated far below the preferred option of requiring more than 180 units for the degree. Mechanical Engineering students had five other options, all somewhat lower than the preferred alternative and all almost equally acceptable but none particularly welcome, as second choice methods to adjust their program in response to an assumed plan to increase the unit values in 5-10 of their required courses.

NuclE+ — For students in Nuclear Engineering, the most preferred option was a reduction in humanities and social science requirements, with an extension of the B.S. beyond 180 units and leaving things as they are favored equally as second choices, not far behind the first choice.

EECS — Students in EECS, like those in Mechanical Engineering, found no option particularly attractive, but tended most to favor leaving things as they are, lowering the number of units required in the humanities and social sciences, and reducing the amount of homework in required courses where it is unnecessarily detailed.

IEOR — In IEOR, where results on the workload questions suggested the problem is less severe than in the other engineering programs, students most favored leaving things as they are and no other alternative was even close as a second choice.

STUDENT LEARNING

Introduction and Crossreferences. This section looks only at some aspects of student learning--principally those concerned with the acquisition of knowledge. Considered here are the respondents' ratings of: the extent to which they will remember what they have learned in their program's coursework; the prospective adequacy (by the time of their graduation) of their skills in basic areas such as written and oral communication and quantitative analysis; and, in the engineering departments, the prospective adequacy of their skills in/on computers. Of directly related interest are the student ratings of the effectiveness of their program in enabling them to obtain a "thorough understanding" of the subject matter, which is discussed as one of a set of six general areas of possible program contribution to the goals of a college/university education (pages 79-86). Also included in this report are student ratings of the extent to which their "overall growth and learning" has been influenced by the instructional process (page 76), which may be compared with six other possible sources of influence. GPA, the traditional measure of student performance in the classroom, is discussed on page 40. Further, apropos of courses in written and oral communication, the views of engineering students

in four programs are reported on page 12. The contribution of engineering students' homework to the learning process is reported on page 55.

Remembering of Material Learned

If GPA is to be regarded as a meaningful measure, particularly insofar as it is based on detailed testing for subject matter knowledge presented in lectures, texts and problem sets or labs, students' retention of what they have learned in their classes would seem to be a very important consideration. Yet we have already seen that overall GPA at UCB bears very little relation to students' ratings of the extent to which they will remember the material learned for their program's courses (see page 40). Here we examine the extent of student agreement with that same proposition, "I will remember a lot of what I have learned in the program's courses for a long time to come" [UMPEO #53]. In response, a majority of the Engineering and Physical Science Sample agreed (S.D. 5-14/28/40-14% S.A.).* There were also some differences in the ratings of the 12 programs [F-prob.= .0001]. Very large majorities agreed that they would retain a lot of what they had learned in Geology (0-4/21/42-33), Physics (0-5/24/46-24) and L&S Computer Science (2-2/25/50-21); in contrast, ratings were significantly lower where agreement was by a plurality or a bare majority, as in Mechanical Engineering (7-21/31/33-8), Chemical Engineering (5-22/23/42-8), EECS (7-20/24/37-13) and Nuclear Engineering (8-13/29/42-8).

Item: I will remember a lot of what I have learned in the program's courses for a long time to come. [UMPEQ Q53].

TOTALS — Engineering and Physcial Sciences

4% Str. Disagree 14% Str. Agree
13% Disagree 28% In Between 40% Agree

Mean: 3.45 ± 0.09 (545) F-probability = .0001

Prog.	Mean	95% Conf.	N		Mean	95% Conf.	N		Mean	95% Conf.	N
MechE	3.14	± 0.23	(86)	MSE+	3.40	± 0.38	(25)	Math	3.50	± 0.28	(36)	*SocS79	3.65	± 0.10(477)
ChemE	3.27	0.27	(60)	CivilE	3.41	0.21	(73)	*XsfLSC	3.57	0.48	(22)	*SHum77	3.67	0.14(267)
EECS	3.28	0.27	(71)	IEOR	3.43	0.31	(21)	Chem	3.61	0.32	(36)	LSComp	3.87	0.23 (52)
NuclE+	3.29	0.46	(24)	*XsfarE	3.48	0.60	(21)	*HlthS77	3.62	0.10(425)		Physic	3.89	0.28 (37)
												Geol	4.04	0.36 (24)

*Mean responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Considered from the perspective of the relative ordering of the mean ratings, all of the engineering programs were ranked below all of the L & S programs in this sample as well as below the average response from students in the Health-related Sciences, Social Science-related, and Selected Humanities Samples. These rankings perhaps reinforce the ideas behind "mastery" and self-paced courses--that while it may well be valuable at one point or another to have studied elements of a subject matter and problem-solving in great detail, it may not be particularly viable to put much faith in the grades awarded for student performance on tests purported to measure their knowledge of such material. Although the responses of the engineering students in no way deny the value of the educational experience and process (though such questioning is not precluded either), it may well be that the vigorous economic demand for engineers is the only guarantee against overemphasis on GPA-based selection criteria in their professions.

Basic Skills

Beyond the general question of retention of material learned, the questionnaires also sought to establish the extent to which students thought that their

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

skills in three (or four) basic areas would be "adequate" by the time of their graduation. The areas of concern were "written communication," "oral communication," "quantitative analysis" and, in the engineering departments, "skills in/on computers." "Adequacy" may, of course, be contingent on the professional expectations the students have about their futures.

Written and Oral Communication. In the area of written communication, a large majority of the respondents agreed (S.D. 4-13/20/45-18% S.A.) that their skills would be adequate by the time they graduated [UMPEO #61]. Very large to overwhelming majorities agreed in Math (0-3/19/47-31), Geology (0-12/4/62-23), and L&S Computer Science (4-10/13/46-27), and these ratings were significantly higher than one or more of those found in IEOR (5-24/24/43-5), Civil Engineering (8-16/28/41-7) and Materials Science (4-24/16/48-8) [F-prob.= .0023]. Math was also rated significantly higher than Mechanical Engineering (8-14/15/43-20). With one minor exception, all of the engineering departments ranked lower than the L & S programs on this item. (For the responses of students in four of the engineering departments to questions about a technical writing course, see page 12.)

Item: My skills in written communication will be adequate by the time I graduate. [UMPEQ Q61].

TOTALS — Engineering and Physical Sciences

4% Str. Disagree
13% Disagree
20% In Between
18% Str. Agree
45% Agree

Mean: 3.60 ± 0.09 (337) F-probability = .0023

Prog.	Mean	95% Conf.	N								
IEOR	3.19	± 0.47	(21)	*XsferE	3.35	± 0.45	(22)	EECS	3.68	± 0.24	(73)
CivilE	3.23	0.24	(75)	NuclE+	3.38	0.45	(24)	*XsfLSC	3.70	0.30	(23)
MSE+	3.32	0.44	(25)	Physic	3.60	0.31	(40)	Chem	3.73	0.31	(37)
MechE	3.52	0.26	(86)	ChemE	3.66	0.24	(62)	LSComp	3.83	0.30	(32)
Geol	3.96	± 0.35	(26)								
Math	4.06	0.27	(36)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: My skills in oral communication will be adequate by the time I graduate. [UMPEQ Q62].

TOTALS — Engineering and Physical Sciences

4% Str. Disagree
14% Disagree
26% In Between
16% Str. Agree
40% Agree

Mean: 3.49 ± 0.09 (334) F-probability = .0552

Prog.	Mean	Conf.	N								
CivilE	3.11	± 0.26	(75)	Geol	3.42	± 0.43	(26)	MechE	3.58	± 0.23	(86)
IEOR	3.24	0.45	(21)	Chem	3.44	0.35	(36)	LSComp	3.63	0.30	(32)
ChemE	3.40	0.26	(62)	*XsferE	3.50	0.47	(22)	Physic	3.64	0.31	(39)
NuclE+	3.42	0.50	(24)	*XsfLSC	3.52	0.37	(23)	Math	3.67	0.33	(36)
EECS	3.68	± 0.21	(72)								
MSE+	3.72	0.37	(25)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Item: My skills in quantitative analysis will be adequate by the time I graduate. [UMPEQ Q63].

TOTALS — Engineering and Physical Sciences

4% Str. Disagree
3% Disagree
11% In Between
29% Str. Agree
56% Agree

Mean: 4.11 ± 0.06 (331) F-probability = .6261

Prog.	Mean	95% Conf.	N								
*XsferE	3.95	± 0.42	(21)	CivilE	4.08	± 0.14	(74)	*XsfLSC	4.13	± 0.27	(22)
ChemE	3.97	0.20	(62)	IEOR	4.10	0.28	(21)	NuclE+	4.17	0.27	(24)
MSE+	4.00	0.27	(25)	EECS	4.11	0.17	(71)	Geol	4.19	0.23	(26)
LSComp	4.04	0.21	(31)	MechE	4.12	0.17	(86)	Physic	4.20	0.31	(40)
Chem	4.22	± 0.20	(36)								
Math	4.34	0.23	(35)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

A (slightly lower) majority of the respondents also agreed (S.D. 4-14/26/40-16% S.A.) that their skills in oral communication would be adequate by the time of their graduation [UMPEQ #62]. By program, agreement ranged from a plurality to a very large majority, with differences between one or two programs being of marginal consequence [F-prob.= .0552]. Compared to the six highest-rated programs, where agreement ranged from 59-64%, ratings tended to be a little lower in

Civil Engineering (9-21/27/35-8%), where the confidence interval did not overlap with that of one large, higher-ranking department, and the ratings in IEOR (5-14/43/29-10) were also far from overwhelmingly positive.

Quantitative Analysis and Skills in/on Computers. Overall, agreement by the respondents that their skills in quantitative analysis would be adequate by the time they graduated was by overwhelming majority (S.D. 0-3/11/56-29% S.A.) [UMPEQ #63]. There was very little difference between program ratings [F-prob.= .6261], with an overwhelming majority, or very nearly so, agreeing in every program.

In the engineering departments, students were also asked whether their skills in/on computers would be adequate by the time they graduated [ESQ #14]. Overall, agreement was only by a plurality (S.D. 8-22/23/32-14% S.A.). As might be expected, however, there were significant differences between some of the program ratings [F-prob.= .0000], with the highest level of agreement, by very large majority, found in EECS (1-8/19/38-33). Agreement that their skills in/on computers would be adequate was also by majority or large majority in IEOR (0-11/28/56-6) and Chemical Engineering (4-19/21/38-19). These ratings were significantly higher than one or more of those observed in the four other engineering departments, in which disagreement or agreement was only by a plurality: Civil Engineering (12-29/29/29-0), Nuclear Engineering (22-22/26/17-13), Mechanical Engineering (10-36/20/23-11) and Materials Science (17-13/29/42-0).

Item: My skills in/on computers will be adequate by the time I graduate. [ES Q14].

TOTALS — Engineering

8% Str. Disagree, 22% Disagree, 23% In Between, 14% Str. Agree, 32% Agree

Mean: 3.21 ± 0.13 (342) F-probability = .0000

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
CivilE	2.76	± 0.24	(68)	MechE	2.89	± 0.26	(83)	*KsfarE	3.29		(21)
NuclE+	2.78	0.58	(23)	MSE+	2.96	0.47	(24)	ChemE	3.49	± 0.31	(53)
IEOR	3.56	± 0.39	(18)								
EECS	3.93	0.23	(73)								

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Basic Goals in the Civil Engineering Program

While the UMPEQ includes a set of items dealing with the most basic goals of all undergraduate educational programs (see pages -), one supplemental questionnaire included items that inquired about the success of the program in meeting four goals of its own formulation. In Civil Engineering, the majors were asked about the extent to which they felt the four goals of the program, as specified in the College of Engineering Announcement, will have been met by the time they have completed their undergraduate work [CEQ #1A-D]. The results were that:

1) *An overwhelming majority of C.E. respondents agreed (S.D. 0-0/16/60-24% S.A.) that they would be "well grounded in the sciences."*
2) *A very large majority agreed (S.D. 2-6/15/68-10% S.A.) that they would have "competent knowledge of the principles that underlie the broad practice of the profession."*
3) *A plurality agreed (S.D. 4-19/41/34-2% S.A.) that they would be "cognizant of economic factors."*
4) *And a plurality disagreed (S.D. 3-43/33/17-4% S.A.) that they would be "educated in social and humanistic studies."*

These results seem to suggest that the Civil Engineering Department's formulation of the latter two goals may represent something of an overstatement in terms of the likely results of study of the current curriculum (or that the courses do not adequately fulfill their mission). Whether the curriculum needs changing so that these goals are addressed more effectively has not been a topic of direct

inquiry here, but even with some strengthening of the C.E. majors' study of relevant economic factors and of social and humanistic studies, these last two goals might warrant restatement. The wording which follows, for example, might better represent the possibilities: "cognizant of (some of?) the principal economic factors which bear upon the practice of civil engineering"; and "acquainted with a variety of social and humanistic studies."

Summary of Problems by Program: Student Learning

This section dealt with whether the respondents believe they will long remember what they have learned in the courses in their programs, and with the adequacy of the skills they expect to have acquired by the time of graduation in basic areas such as written and oral communication, quantitative analysis and, in the engineering departments, skills in/on computers. For the treatment of other aspects and measures of learning, see the crossreferences noted on pages 56-57.

MechE
ChemE
EECS
NuclE+

Ratings concerning whether students would long remember what they had learned in their program's courses were somewhat below par for the campus, with agreement only by plurality or bare majority, in Mechanical Engineering, Chemical Engineering, EECS and Nuclear Engineering. Students in Mechanical Engineering and Nuclear Engineering also felt that their skills in/on computers would not be adequate by the time they graduated.

CivilE
IEOR
MSE+

Student ratings of the likely adequacy of skills in written communication (by the time of graduation) were not particularly strong in Civil Engineering, IEOR or Materials Science. On the average, Civil Engineering and IEOR students gave similarly weak positive ratings to the likely adequacy of their eventual skills in oral communication. In addition, Civil Engineering and Materials Science students did not rate their skills in/on computers as likely to be adequate by the time they graduated. *In Civil Engineering also, the program was not rated as particularly successful in meeting its goal of having students become "cognizant of economic factors," and the respondents were even less convinced that they would be "educated in social and humanistic studies."*

PROVISION OF INFORMATION TO STUDENTS

Introduction and Crossreferences. This portion of the report deals with the helpfulness of program office staff, the orientation provided for students new to the major, and with the sufficiency or adequacy of various kinds of information needed by students. In this last regard, specifically of concern are the programs' systems of providing information about career opportunities for students with a bachelor's degree from the program, graduate and professional schools, and professors and courses. In the engineering departments, there is a supplementary focus on the adequacy of guidance/information to help students to select breadth courses in the humanities and social sciences. In engineering, students were also

asked if they know enough now to decide "when and whether" to attend graduate school, and if they are fully aware of the registration/licensing requirements in their field (if any).

While faculty are ultimately responsible for the sufficiency and adequacy of information systems in their programs, the more interpersonal aspects of faculty advising and accessibility, and their attitudes toward students (as students see them), are treated in the sections on "Faculty-Student Contact" and "Faculty Receptivity to Students" (pages 23-31). In light of the students' views about the sufficiency of information provided about graduate and professional schools, and about career opportunities, the reader may also wish to consider the results of student ratings of the extent of program contributions to student preparation for graduate study and/or a career (see pages 83-85). Additional information on students' career interests is also available in Appendix A (pages A-6-A-10).

Program Office Staff. Department office staff are often the first point of contact with a program for the student, and may continue to make a large difference in terms of providing information and referrals, and even in facilitating the interaction between faculty and students. Faculty attitudes, departmental practices and other factors, however, may make some difference in how well office staff can perform their duties in support of the program and its students.

Program office staff often are quite helpful and conscientious in their work, and they usually receive good ratings from most students. To some extent, this observation held up in the Engineering and Physical Science programs, where a large majority of the respondents agreed (S.D. 3-8/22/49-18% S.A.)* that their program office staff are "generally quite helpful" [UMPEQ #59]. However, the mean student ratings of office staff in all of the departments in the Colleges of Engineering and Chemistry, and in the L&S Computer Science program, were ranked below those found in the three L & S Physical Science departments, as well as below the average ratings for the total samples in the Health-related Sciences, Selected Humanities and Social Sciences. There were significant differences between some of the program ratings within the Engineering and Physical Science Sample [F-prob.= .0000].

Item: The program's office staff are generally quite helpful. [UMPEQ Q59].

TOTALS — Engineering and Physical Sciences

3% Str. Disagree, 8% Disagree, 22% In Between, 18% Str. Agree, 49% Agree

Mean: 3.71 ± 0.08 (310) F-probability = .0000

Prog.	Mean	95% Conf.	N								
LSComp	3.09	± 0.31	(43)	Chem	3.62	± 0.33	(37)	ChemE	3.79	± 0.21	(53)
*XsfLSC	3.27	0.57	(22)	MSE+	3.64	0.37	(25)	CivilE	3.81	0.21	(70)
EECS	3.41	0.25	(63)	*XsferE	3.65	0.46	(20)	IEOR	3.86	0.41	(21)
MechE	3.44	0.23	(75)	NuclE+	3.73	0.44	(22)	*HlthS77	3.91	0.10	(416)

*Hum77	3.95	± 0.13	(269)								
*SocS79	4.02	0.09	(472)								
Math	4.03	0.22	(36)								
Geol	4.38	0.30	(26)								
Physic	4.44	0.19	(39)								

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Agreement that program office staff are generally quite helpful was only by plurality in L&S Computer Science (S.D. 9-16/33/40-2% S.A.)--and this rating is the second-lowest of any of the 47 programs thus far evaluated by the ARU. Ratings in EECS (6-11/24/52-6) and Mechanical Engineering (4-15/24/48-9) were also significantly lower than found in all three high-rated L & S departments in this sample. Ratings of program office staff in Chemistry (3-8/32/38-19) and Materials Science (4-4/28/52-12) were perhaps a little better, but they were still significantly lower than found in two of the L & S departments. Ranking slightly better,

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

with fairly good ratings, nearly average for U.C. as a whole, were Nuclear Engineering (5-5/23/50-18%), Chemical Engineering (2-0/30/53-15), Civil Engineering (0-10/19/51-20) and IEOR (0-10/19/47-24). These four departments had mean ratings that tended to be significantly above L&S Computer Science but still tended to be below one or both of the two highest-rated L & S departments. The highest ratings of the general helpfulness of program office staff, with performances apparently little short of outstanding, were found in Physics (0-0/5/46-49) and Geology (0-4/4/42-50), where strong agreement reached a majority, and also in Math (0-2/11/67-19), where the overall level of agreement also reached overwhelming proportions.

Orientation for New Students. The orientation provided by the program can be especially useful to acquaint new majors with the curriculum, with contact persons and points, with other useful information (such as discussed subsequently), and even with faculty. The inquiry about whether the program provides a good general orientation to the major [UMPEQ #19] elicited about as much disagreement as agreement (S.D. 12-25/24/33-6% S.A.). There were no significant differences between the program ratings [F-prob.= .3910], which ranged only from plurality agreement to bare majority disagreement.

Item: The program provides a good general orientation for students new to the major. [UMPEQ Q19].

TOTALS — Engineering and Physical Sciences

12% Str. Disagree
25% Disagree
24% In Between
33% Agree
6% Str. Agree

Mean: 2.95 ± 0.10 (306) F-probability = .3910

Prog.	Mean	95% Conf.	N						
LSComp	2.54	± 0.34	(46)	*SHum77	2.82	± 0.15	(239)	MSE+	2.96	± 0.44	(23)	Geol	3.09	± 0.60	(23)
Math	2.73	0.35	(33)	Chem	2.91	0.44	(33)	CivilE	2.96	0.29	(71)	*XafLSC	3.09	0.54	(24)
NuclE+	2.78	0.43	(23)	*ElcS77	2.92	0.11	(401)	MechE	2.97	0.27	(77)	EECS	3.10	0.25	(68)
*XafarS	2.82	0.47	(22)	Physic	2.94	0.40	(35)	IEOR	3.00	0.46	(20)	ChemE	3.19	0.30	(54)
												*SocS79	3.27	0.13	(457)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

Informational Needs of Students

Information on Courses and Professors. A number of questions were asked about the quality or sufficiency of information available to students. For one, respondents were asked whether "the program's system of information and advising (faculty, secretaries, catalogs, etc.) makes it easy for me to choose courses, professors, and to understand how best to meet my academic needs" [UMPEQ #18]. Overall, only a plurality of the respondents agreed (S.D. 9-22/24/35-9% S.A.), but there were significant differences between some of the program ratings [F-prob.= .0002]. Programs where more than a bare majority of students agreed that the information and advising system made it easy to choose courses and professors, such as Geology (4-15/12/38-31), especially, and also Chemical Engineering (8-11/23/43-15), Math (2-26/13/42-16) and Chemistry (6-14/25/44-11) were rated significantly higher than one or more of those where disagreement prevailed by a plurality, such as Materials Science (21-21/33/21-4), L&S Computer Science (10-29/37/23-2) and Mechanical Engineering (13-29/26/28-4). Geology also rated above EECS (11-24/23/36-5). Programs involving College of Engineering departments and faculty (including L&S Computer Science) were rated lowest on this item.

Item: The program's system of information and advising (faculty, secretaries, catalogs, etc.) makes it easy for me to choose courses, professors, and to understand how best to meet my academic needs. [UMPEQ Q18].

TOTALS — Engineering and Physical Sciences

9% Str. Disagree
22% Disagree
24% In Between
35% Agree
9% Str. Agree

Mean: 3.13 ± 0.10 (556) F-probability = .0002

Prog.	Mean	95% Conf.	N						
MSE+	2.67	± 0.49	(24)	EECS	3.01	± 0.26	(74)	IEOR	3.19	± 0.47	(21)	*SocS79	3.31	± 0.11	(482)
LSComp	2.79	0.27	(52)	NuclE+	3.13	0.47	(24)	Physic	3.21	0.40	(39)	Chem	3.42	0.36	(36)
MechE	2.80	0.24	(85)	CivilE	3.17	0.26	(76)	*XafLSC	3.21	0.47	(24)	Math	3.42	0.37	(38)
*XafarS	2.82	0.43	(22)	*SHum77	3.19	0.14	(280)	*ElcS77	3.27	0.11	(426)	ChemE	3.44	0.29	(61)
												Geol	3.77	0.48	(26)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

In the engineering departments, results on a related item support the tentative conclusions suggested above, that most of the course and professor-related information and advising systems are not yet as good as they realistically could be. Engineering students were asked whether they have had adequate guidance/information to select courses to fulfill their humanities and social science requirements [ESQ #5], and a plurality disagreed (S.D. 18-28/19/31-3% S.A.). The two programs where a bare majority agreed, Chemical Engineering (4-20/26/43-7) and Nuclear Engineering (14-18/18/41-9) tended to be rated significantly better than departments where more than a bare majority disagreed, including Mechanical Engineering (28-29/16/25-1) and Civil Engineering (21-36/18/22-3) [F-prob.= .0012].

Item: I have had adequate guidance/information to select courses to fulfill my humanities and social sciences requirements. [ES Q5].

TOTALS — Engineering

18% Str. Disagree, 28% Disagree, 19% In Between, 3% Str. Agree, 31% Agree

Mean: 2.73 ± 0.13 (331) F-probability = .0012

Prog.	Mean	95% Conf.	N							
MechE	2.43	± 0.26	(79)	*Xsferf	2.62	±	(21)	EECS	2.73 ± 0.27	(71)	NuclE+	3.14 ± 0.35	(22)
CivilE	2.50	0.26	(72)	MSE+	2.73	0.31	(22)	IEOR	2.95 0.32	(19)	ChemE	3.28 0.30	(46)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Information about Graduate and Professional Schools. When asked if their faculty and program provide enough information about graduate and professional schools [UMPEQ #17], a clear plurality of the respondents disagreed (S.D. 11-36/29/19-5% S.A.). Only in Chemistry did as much as a plurality agree (3-28/22/44-3), while disagreement prevailed by a large majority only in EECS (17-49/24/5-5). Although these two departments' confidence intervals did not overlap, differences within the set of 12 program means were only of borderline significance statistically [F-prob.= .0577]. Disagreement that their faculty/program provide enough information about graduate and professional schools prevailed by a majority in a few other instances as well, but, in any case, no program was really well-rated.

Item: The faculty and program provide enough information about graduate and professional school programs to which I might want to apply. [UMPEQ Q17].

TOTALS — Engineering and Physical Sciences

11% Str. Disagree, 36% Disagree, 29% In Between, 5% Str. Agree, 19% Agree

Mean: 2.69 ± 0.09 (481) F-probability = .0577

Prog.	Mean	95% Conf.	N										
EECS	2.30	± 0.25	(63)	Math	2.66	± 0.28	(32)	*XsfLSC	2.71	± 0.30	(21)	Geol	2.87 ± 0.46 (23)
*Xsferf	2.53	0.34	(19)	IEOR	2.67	0.40	(15)**	CivilE	2.72	0.25	(71)	Physic	2.91 0.43 (35)
LSComp	2.60	0.30	(47)	NuclE+	2.67	0.48	(21)	*SHum77	2.83	0.15	(235)	*SocS79	2.96 0.11 (422)
MechE	2.63	0.24	(72)	MSE+	2.68	0.31	(19)	ChemE	2.84	0.33	(31)	*HltS77	3.03 0.10 (390)
												Chem	3.16 0.36 (32)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

In the engineering departments, a majority of the students agreed (S.D. 8-18/19/42-13% S.A.) that they knew enough now to enable them to make effective choices about the general question of "when and whether to attend graduate school" (but "not which graduate school to attend") [ESQ #25]. There were no significant differences between the program ratings [F-prob.= .4288], with agreement ranging from a plurality to a large majority.

Item: I feel I know enough now to enable me to make effective choices about when and whether to attend graduate school [not which graduate school to attend]. [ES Q25].

TOTALS — Engineering

8% Str. Disagree, 18% Disagree, 19% In Between, 13% Str. Agree, 42% Agree

Mean: 3.34 ± 0.12 (336) F-probability = .4288

Prog.	Mean	95% Conf.	N										
*Xsferf	3.05		(20)	ChemE	3.16	± 0.33	(31)	MSE+	3.38	± 0.46	(24)	CivilE	3.49 ± 0.27 (70)
EECS	3.15	± 0.28	(71)	MechE	3.36	0.25	(73)	NuclE+	3.45	0.38	(22)	IEOR	3.65 0.38 (20)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

The reader is also referred to the items about the extent of student interest in and program contributions to "preparation for graduate or professional school" (page , and page A-6 of Appendix A).

Information about Careers. Disagreement led agreement by a narrow plurality (S.D. 10-31/24/29-7% S.A.) concerning whether the faculty and program provide enough information about careers for students with a bachelor's degree in their major [UMPEQ #16]. While in no program was the provision of such information rated particularly well, departments in the College of Engineering and College of Chemistry, and the L&S Computer Science group major program, all ranked above the L & S departments in the sample and, with one minor exception, above the averages for the total samples (but not every program) in the Selected Humanities, Health-related Sciences and Social Sciences. (Given the professional nature of the engineering programs, this result perhaps should be expected.) The insufficiency of information about bachelor-level careers was noted by an overwhelming majority in Math (19-69/3/6-3), and by large majorities in Geology (24-40/12/24-0) and Physics (27-36/15/15-6). Among the engineering and College of Chemistry departments, Mechanical Engineering students alone disagreed by a majority (15-37/18/25-5). Math's ratings were significantly lower than all programs except those thus far cited; and Geology, Physics and Mechanical Engineering were significantly below two of the three highest-rated departments [F-prob.= .0000]. But even in the highest-rated programs, agreement that their faculty and program provide enough information about career opportunities for students with a bachelor's degree in the major was never above a bare majority: L&S Computer Science (4-19/31/37-10), Civil Engineering (4-26/22/41-8), and Materials Science (4-25/21/46-4).

Item: The faculty and program provide enough information about career opportunities for students with a Bachelor's degree in this major. [UMPEQ Q16].

TOTALS -- Engineering and Physical Sciences

10% Str. Disagree, 31% Disagree, 24% In Between, 7% Str. Agree, 29% Agree

Mean: 2.91 ± 0.10 (321) F-probability = .0000

Prog.	Mean	95% Conf.	N							
Math	2.06	± 0.32	(32)	*ElcS77	2.53	± 0.11	(396)	*XsfLSC	2.82	± 0.57 (22)
*SHum77	2.18	0.13	(233)	*XsferE	2.67	0.48	(21)	IEOR	2.84	0.49 (19)
Geol	2.36	0.46	(25)	MechE	2.68	0.26	(79)	NuclE+	2.95	0.32 (22)
Physic	2.36	0.43	(33)	*SocS79	2.69	0.11	(441)	Chem	3.03	0.40 (32)

EECS	3.06	± 0.25 (70)
ChemE	3.08	0.27 (59)
MSE+	3.21	0.43 (24)
CivilE	3.23	0.24 (74)
LSComp	3.29	0.29 (52)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

In the engineering departments, although information available from the program on career opportunities often may not be sufficient or adequate, from what students knew about the Career Planning and Placement Center (CPPC), a very large majority agreed (S.D. 4-7/17/51-21% S.A.) that CPPC services seem adequate to meet their needs for career planning, search and placement [ESQ #29]. There were no significant differences among the seven departmental means as a whole [F-prob.= .2502], but the confidence intervals for Materials Science (17-0/8/58-17) and Civil Engineering (0-9/25/52-14) tended not to overlap with that for Nuclear Engineering (0-0/11/44-44), where CPPC services were rated especially well.

Item: From what I know about the Career Planning and Placement Center so far, the services seem adequate to meet my needs for planning/search/placement. [ES Q29]

TOTALS -- Engineering

4% Str. Disagree, 7% Disagree, 17% In Between, 21% Str. Agree, 51% Agree

Mean: 3.80 ± 0.11 (303) F-probability = .2502

Prog.	Mean	95% Conf.	N							
MSE+	3.33	± 0.54	(24)	IEOR	3.74	± 0.42	(19)	*XsferE	3.78	(18)
CivilE	3.70	0.21	(64)	ChemE	3.76	0.27	(46)	MechE	3.78	± 0.30 (68)

EECS	3.89	± 0.21 (64)
NuclE+	4.33	0.34 (13)**

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

The reader is also referred to the items about the extent of student interest in and program contributions to "preparation for a career" (page 84) and to the material about careers contained in Appendix A (pages A-6-A-10).

Registration Requirements in the Engineering Departments. A bare majority of the engineering respondents disagreed (S.D. 22-28/17/20-12% S.A.) that they were aware of the registration requirements, if any, to become a (licensed) professional engineer in their field [ESQ #31A]. A number of factors affect these responses in unknown ways, since there are no registration requirements for students who are not planning to pursue professional work on a self-employed or consulting basis or who are in portions of programs where there are no registration requirements (e.g., Computer Science, Electronics). Since completion of registration requirements may be pursued after employment begins in the field, perhaps the most important concern here is whether students know enough about registration requirements to enable them to make effective decisions about when, if ever, to begin fulfillment of the requirements. Apart from making a special effort to make available to students information which clarifies the nature of registration requirements in their field, perhaps a brief explanation of the requirements in general, the engineer-in-training exams, the possible use of the Cooperative Work-Study Program, and referrals to more complete sources of information, could be included in the Announcements for the Colleges of Engineering and Chemistry.

Bearing in mind the differential applicability of this item in the several engineering departments and the unknown factors in the students' responses, it may then be noted that only in Civil Engineering (10-18/18/33-22) were a majority of the students aware of registration requirements (if any) in their field. Disagreement was by very large majority, by contrast, in EECS (35-37/18/9-0), perhaps indicating a lack of clarity about where there are registration requirements and where there are not. Disagreement was by large majority in IEOR (22-44/17/11-6), by majority in Chemical Engineering (21-37/12/23-8) and Nuclear Engineering (14-38/19/19-10), and by plurality in Mechanical Engineering (24-24/16/19-16) and Materials Science (27-14/27/14-18). There were statistically significant differences between several of the program ratings [F-prob.= .0000], but the real meaning of the differences is not entirely clear, especially without a reasonable knowledge of the interaction of student interests and the requirements in each of the fields.

Item: I am aware of the registration requirements, if any, to become a (licensed) professional engineer in my field. [ES Q31A].

TOTALS — Engineering

22% Str. Disagree, 28% Disagree, 17% In Between, 20% Agree, 12% Str. Agree

Mean: 2.72 ± 0.14 (330) F-probability = .0000

Prog.	Mean	95% Conf.	N							
EECS	2.02	± 0.24	(65)	ChemE	2.60	± 0.35	(52)	NuclE+	2.71	± 0.36 (21)
IEOR	2.33	0.37	(18)	*KaferE	2.60		(20)	MechE	2.30	0.32 (79)
MSE+	2.32	± 0.65	(22)							
CivilE	3.40	0.30	(73)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Engineer-in-Training Exams. When asked whether they intended to complete the Engineer-in-Training exam before finishing their undergraduate work [ESQ #31C], only 67.8% of the respondents chose one of the 1-5 scaled responses. Of these students, a slight plurality disagreed and 39% agreed (S.D. 18-27/16/15-24% S.A.). (These exams are required for completion of registration requirements, and it is strongly recommended that they be taken while the student's knowledge is still fresh about the breadth of the subject matter in their field--i.e., before specialization in work after college.) Although there was a "large" difference between some of the program ratings [F-prob.= .0000], these results are subject to the qualifications noted in the first paragraph about registration requirements. A very large majority of Civil Engineering students, with 82% responding on the 1-5 scale, agreed (6-10/13/24-48), as did a narrow plurality in Mechanical Engineering

(9-30/17/15-30%), with 64% responding. The two lowest-rated programs were EECS (30-37/17/9-7, with a 62% response) and Chemical Engineering (29-37/16/11-8, with a 66% response). Other results concerning whether the students intend to take the Engineer-in-Training exam before graduation include: IEOR (30-40/0/10-20, with 48% in response), Materials Science (21-26/26/16-11, @ 79%) and Nuclear Engineering (25-25/19/19-13, @ 67%).

Item: I intend to complete the Engineer-in-Training examination before finishing my undergraduate work. [ES Q31C].

TOTALS — Engineering

18% Str. Disagree | 24% Str. Agree
27% Disagree | 16% In Between | 15% Agree
*Mean: 2.99 ± 0.19 (246)** | F-probability = .0000*

Prog.	Mean	95% Conf.	N							
EECS	2.24	± 0.35	(46)**	IEOR	2.30	± 1.13	(10)**	NuclE+	2.69	± 0.75 (16)**
ChemE	2.32	0.41	(38)**	MSE+	2.68	0.62	(19)	MechE	3.26	0.38 (54)**
*XferE	3.27		(15)**							
CivilE	3.97	± 0.32	(63)							

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Access to Work and Personnel in the Engineering Fields. Without knowing the proportion of students to whom registration is a real concern (or would be, if they knew enough about it), the precise meaning of the responses to the items following remains somewhat obscured (see "Registration Requirements . . .," page 65). With only 78.5% of the respondents choosing one of the 1-5 scaled response categories, a very large majority disagreed (S.D. 39-34/5/12-10% S.A.) that they had worked or were working with a registered engineer while in school, or had ready access to such work were they to ask [ESQ #31B]. Though disagreement still prevailed by at least a majority, ratings were significantly higher in Civil Engineering (26-32/3/19-19), with Materials Science (33-28/0/22-17) rated nearly as highly, than in two to four of the lowest-rated programs, where disagreement was by 76-88% [F-prob.= .0073].

Item: I have worked/am working part-time with a registered engineer while in school, or have ready access to such work were I to ask. [ES Q31B].

TOTALS — Engineering

39% Str. Disagree | 10% Str. Agree
34% Disagree | 3% In Between | 12% Agree
Mean: 2.21 ± 0.16 (285) | F-probability = .0073

Prog.	Mean	95% Conf.	N							
IEOR	1.88	± 0.57	(17)	NuclE+	2.00	± 0.66	(17)**	*XferE	2.17	(18)
EECS	1.91	0.30	(58)	MechE	2.00	0.30	(65)	ChemE	2.19	± 0.38 (48)
MSE+	2.61	± 0.78	(18)**							
CivilE	2.74	0.38	(62)							

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

The Cooperative Work-Study Program (CWSP) exists to facilitate students' access to the professional world of work (with "stop-out" from school to work six or more months). One item explored the students' relationship to the CWSP [ESQ #28]. The responses, which did not differ significantly by program [Chi-Square-prob.= .2417], were as follows for 339 of 363 possible respondents:

6.2% have available independently what CWSP provides;
13.0% have worked/am working in CWSP;
4.7% unable to locate a satisfactory employer;
11.2% don't know how to apply for a CWSP position;
8.3% cannot/will not extend beyond 4-year college program;
4.7% do not feel qualified enough to apply;
38.9% not interested or not applicable;
13.0% other.

Perhaps in accord with these results and the students' relative lack of sufficient information from their departments about career opportunities for people with a bachelor's degree in the field, a very large majority of the respondents agreed (S.D. 1-5/22/54-18% S.A.) that they were interested in more opportunities for contact with UCB alumni or others working in the profession, or with companies

or agencies in their field [ESO #30]. There were no significant differences between the program ratings [F-prob.= .9835], with agreement falling in a very narrow range from 64% to 78%.

Item: I am interested in more opportunities for contact with UCB alumni or others working in the profession, and/or with companies or agencies in the field. [ES Q30].

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
EECS	3.77	± 0.17	(69)	NuclE+	3.83	± 0.36	(23)	ChemE	3.85	± 0.25	(32)	CivilE	3.90	± 0.18	(69)
MSE+	3.79	0.35	(24)	MechE	3.83	0.20	(78)	IEOR	3.89	0.38	(18)	*XsferE	4.05		(21)

TOTALS — Engineering

1% Str. Disagree, 5% Disagree, 22% In Between, 18% Str. Agree, 54% Agree

Mean: 3.83 ± 0.09 (333) F-probability = .9835

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Summary of Problems by Program: Provision of Information to Students

Topics of concern in this section include the sufficiency of information provided by the faculties and programs about: courses and professors, graduate and professional schools, and careers. In the engineering departments, items also focused on the adequacy of guidance/information to aid in selection of humanities and social science courses, if students now know enough to make effective choices about "when and whether" to attend graduate school, knowledge about registration requirements (if any), and the extent to which students wanted more contact with professionals and agencies in the field. Finally, also of concern in the entire sample are some of the mechanisms for providing information, including the program's orientation for students new to the major and the general helpfulness of the program office staff. For other sections dealing with faculty advising, preparation for graduate or professional school, and for careers, see the crossreferences noted on page 61.

The sufficiency of information about career opportunities for students with a bachelor's degree was rated especially poorly in Math, and poorly in Physics and Geology. Moreover, there was not enough information provided about graduate and professional schools either. Information about courses and professors was also inadequate for some Physics students. The orientation provided for new Math majors was regarded as somewhat weak, and it was adequate at best in Physics and Geology. — Math, Physic, Geol

The orientation for new majors provided by the L&S Computer Science program was weak and the general helpfulness of the program office staff was rated below that found in 45 of the other 46 undergraduate programs thus far evaluated by the ARU. The program also did not provide enough information about courses and professors, or about graduate and professional schools. — LSComp

In Chemistry, ratings of program office staff were good, but not as good as in most programs, and the orientation for new majors was adequate at best. Not quite enough information was provided about possible graduate or professional schools, nor about bachelor's-level careers. — Chem

The Engineering Programs. Many of the ratings in this section fell in a narrow range from somewhat weak to adequate, such that the mention of the same problem areas would, in the usual format, be repeated for each program. To reduce this repetition, this summary has been organized by topic area, with reference to all engineering departments or, in one case, to the departments in the College of Engineering. Thus the individual programs are listed multiply, and cited in the margins when especially weak.

All engg & esp. EECS MechE MSE+

A) Program Office Staff and Orientation for New Majors. None of the engineering departments provided a good orientation for students new to the program, though none of them was especially weak either. Although at least a majority of the respondents in all of the engineering programs agreed that their program's office staff are generally quite helpful, seldom was there much "strong agreement," and these ratings, particularly in EECS and Mechanical Engineering and, to a lesser extent, in Materials Science, were somewhat lower than those found in most L & S programs (excluding L&S Computer Science).

Collg of Engg & esp. MechE MSE+ CivilE EECS

B) Information about Courses and Professors. With Materials Science and Mechanical Engineering seeming least adequate, the College of Engineering faculties and programs did not really provide enough information about courses and professors, so that, for many students, it was not particularly easy to understand how best to meet their academic needs. In providing guidance/information for selecting courses to fulfill humanities and social science requirements, the College of Engineering programs were usually rated a little lower yet, with Mechanical Engineering and Civil Engineering weakest, and Materials Science and EECS not rated very well either.

All engg & esp. EECS ChemE

C) Information about Graduate and Professional Schools. There was not enough information provided by the engineering programs/faculties about graduate and professional schools to which their students might want to apply, especially in EECS. In EECS and Chemical Engineering, more students than in the other programs seemed not to know enough yet to make effective choices about <u>when</u> and <u>whether</u> to attend graduate school (i.e., not which school to attend).

All engg & esp. MechE

D) Information about Careers. With Materials Science and Civil Engineering being marginally more adequate, there was also not really enough information provided by the programs/faculties on career opportunities for students with a bachelor's degree (though the record here is better than in most L & S departments, sometimes much better), with Mechanical Engineering's performance being lowest. (For reference and student referral, the Career Planning and Placement Center was rated fairly well.) Apart from Civil Engineering, students usually disagreed also that they were "aware of the registration requirements, if any, to become a (licensed) professional engineer" in their field.

STUDENT PARTICIPATION IN PROGRAM DECISION-MAKING

<u>Introduction: The Chancellor's Office Plan and the Divisional Senate's Rollback</u>

The Chancellor's Office, in response to U.C. President Saxon's recent policy on student participation in University governance, has come out this Fall with a draft plan for student participation in campus governance. The principles

enunciated in the policy statement are generally supportive of recognizing the value of student participation in University decision-making, including in the academic realms (and in departments), and of increasing the extent and effectiveness of student participation. Although President Saxon asked the Academic Senate to consider favorably his principles, the campus plans exclude the Berkeley Division (of the Academic Senate) because President Saxon could not readily include the Senate within the purview of the policy statement (if only for political reasons).[1]

Included in the Berkeley campus draft plan for student participation are a number of areas of decision-making in which departments are urged to make provision, in one way or another, for students to hear and be heard in the course of department or program decision-making. In addition, in Attachment III of the campus plan, as part of a report by Professor Parkinson, Appendix B presents the results of a Spring 1980 Registration Packet survey of students about student participation. In Appendix B, breakdowns of the student responses by department are presented for survey items concerned with the extent of student participation on departmental committees and in student organizations, as well as on perceptions of the seriousness of consideration given by departments to student views, and the extent to which "speaking up" is seen as likely to have a negative affect on a student's relationship with departmental faculty/administrators. (This appendix also shows the campuswide student response to all of the items in the survey.)

In the evaluation at hand, a number of items focused essentially on three areas: the extent to which students trust faculty to take student needs and views into account in program decision-making; the departmental student organizations (or student professional societies); and teaching evaluation.

Trust of Faculty Decision-making

When asked whether they trust faculty to take student needs and views into account in their decision-making for the program, a modest plurality of the

[1]The Berkeley Division, upon recommendation of its Committee on Senate Policy, in late October of 1980, conducted a mail ballot of all regular faculty, seeking their views on nine "principles of student participation." Based on the Division's responses, the Committee plans to introduce various changes in the By-Laws pertaining to student participation in the Division's committees.

If implemented in the Division's By-Laws, as intended by the Policy Committee (as shown in its drafts of proposed changes), these "principles" would: 1) rescind students' limited membership status on nine Divisional committees, replacing it with a lower status as "participant" with few(er) and undefined rights of participation; 2) extend student participation to nine more committees, four of which already accept student appointees (but only two of the new committees are of any consequence); 3) allow committees to exclude students for portions of deliberations where faculty feel it advisable to do so (a new provision); and 4) remove authority for students to appoint their representatives (via the ASUC and Graduate Assembly), replacing that process with selection of a panel of nominees by the Division's Committee on Student Affairs and final selection by the committees on which the students are to serve. The ballot also put the Division on record: 5) in opposition to student participation on many committees, including several committees of considerable importance and the Committee on Academic Freedom (where students have previously served at UCB and still do on every other U.C. campus); and 6) in opposition to students' requests for a grant of floor privileges of a limited character at meetings of the Berkeley Division and its Representative Assembly (even though such privileges are granted to students at every other U.C. campus).

Engineering and Physical Sciences students agreed (S.D. 8-21/33/31-8% S.A.),* with few showing either strong trust or strong mistrust [UMPEQ #56]. While these responses by no means indicate an overwhelming perception that faculty give due weight to student needs and views, they are roughly similar (or even a little more indicative of trust) to those found among other students at UCB. There were no differences between program ratings [F-prob.= .3280], with responses ranging only from plurality disagreement to strong plurality agreement.

Item: I trust the faculty to take student needs and views into account in their decision-making for the program. [UMPEQ Q56].

TOTALS — Engineering and Physical Sciences

8% Str. Disagree
21% Disagree
33% In Between
31% Agree
8% Str. Agree

*Mean: 3.10 ± 0.09 (546)
F-probability = .3280*

Prog.	Mean	95% Conf.	N
*SHum77	2.72	± 0.13	(261)
MSE+	2.84	0.41	(25)
Chem	2.88	0.31	(34)
LSComp	2.88	0.28	(51)
*SocS79	2.94	± 0.10	(472)
Math	3.00	0.35	(37)
*HistS77	3.03	0.10	(413)
NuclE+	3.04	0.46	(23)
MechE	3.06	± 0.26	(82)
CivilE	3.10	0.24	(76)
Physic	3.15	0.38	(39)
Geol	3.20	0.51	(25)
EECS	3.21	± 0.22	(73)
IEOR	3.24	0.43	(21)
*XsferE	3.24	0.57	(21)
ChemE	3.42	0.26	(60)
*XsfLSC	3.48	0.39	(20)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Student Organizations and Participation in Program Decision-Making

Student Organizations: Notice of Meeting. Overall, only a moderate-sized majority of the respondents disagreed (S.D. 23-34/13/18-12% S.A.) that they had "never been notified of a meeting of a general undergraduate organization (or professional society, where equivalent)" in their program [UMPEQ #54].** In the engineering departments, considered separately, where the student professional societies can play a somewhat more real and meaningful role in career development if not also in program decision-making, the response was a little better, with a large majority denying that they had never received notice of meeting (S.D. 27-36/14/15-9% S.A.). Since the response for the entire Social Science Sample was ranked better than were all but one of the engineering departments, however, it would seem that notices of undergraduate professional society meetings should be more systematically distributed (e.g., at least three times a year).

Item: I have never been notified of a meeting of a general undergraduate organization (or professional society, where equivalent) in this program. [UMPEQ Q54.] [1977, 1979 wording: ~~(or professional society, where equivalent)~~.]

TOTALS — Engineering and Physical Sciences

23% Str. Disagree
34% Disagree
13% In Between
18% Agree
12% Str. Agree

*Mean: 2.62 ± 0.11 (333)
F-probability = .0000*

Prog.	Mean	95% Conf.	N
CivilE	1.93	± 0.23	(75)
*SocS79	2.07	0.11	(435)
Physic	2.13	0.41	(40)
IEOR	2.33	0.51	(21)
MechE	2.47	± 0.27	(85)
ChemE	2.52	0.33	(62)
NuclE+	2.54	0.51	(24)
*SHum77	2.64	0.13	(260)
EECS	2.67	± 0.33	(70)
Geol	2.85	0.52	(26)
*XsferE	2.91	0.63	(22)
*XsfLSC	2.91	0.57	(23)
MSE+	3.00	± 0.60	(25)
Math	3.03	0.43	(38)
*HistS77	3.05	0.15	(411)
LSComp	3.06	0.40	(30)
Chem	3.71	0.37	(37)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

*See next page for the scale associated with these percentage responses.

**Although the items on notice of meetings and on distribution of teaching evaluation forms [page 74] are phrased absolutely ("never," "each"), some respondents shaded the strength of agreement or disagreement (though they tended to avoid the middle response). Various reasons may account for the shading, including: the receipt of a meeting notice one year but not another; receipt of notice(s) of meeting of some group(s) other than a general undergraduate association; no receipt of notice but being newly declared into the major. On the item about teaching evaluation forms, some students may have given relative responses when taking more than one class from the program (and not always receiving a form); or some may not have been entirely sure if they were absent from (some) class(es) and did not receive a teaching evaluation form.

There was a "considerable" spread between the means of the highest and lowest-rated programs as regards students' receipt of at least one notice of an undergraduate organization meeting [F-prob.= .0000]. At one extreme, a large majority of students in Chemistry agreed (S.D. 3-16/14/41-27% S.A.)* that they had never been notified of a meeting of a general undergraduate organization--and this response was significantly worse than that found in seven other programs--and in no other program did agreement exceed disagreement. Among the other programs where notice of meetings were not particularly effective in reaching all students at least once were L&S Computer Science (16-24/20/18-22), Math (11-37/5/34-13) and Materials Science (20-20/20/20-20). The department which provided the most effective notice of meetings was Civil Engineering, where a very large majority disagreed (40-39/12/7-3). These ratings were significantly better than those in about nine of the other programs, and notice of meetings in Physics (40-35/5/13-8) were also more likely than in four other programs to have been received by students. IEOR (19-52/10/14-5) was third-most effective. Programs in the middle of the distribution, with disagreement prevailing over agreement by progressively weaker margins, typically with more effective notice of meetings than in Chemistry but less effective than in Civil Engineering, included Mechanical Engineering (24-39/13/16-8), Chemical Engineering (19-47/10/11-13), Nuclear Engineering (21-38/13/25-4), EECS (29-19/21/20-11) and Geology (8-50/8/19-15).

Student Participation in the Professional Societies in the Engineering Departments. About one-third (33%) of the respondents were active, or occasionally attended or participated, in their department's professional society, with one in nine (11%) fairly active [ESQ #33]. Another 23% were members, but inactive, and 43% were not members. The level of active and occasional participation went as high as 48% in Nuclear Engineering and 43% in Civil Engineering, while the lowest levels were 25-29% for EECS, Chemical Engineering, Materials Science and Mechanical Engineering [Chi-Square prob.= .0052, using the original four response categories]. Honor student societies in the departments also seemed to exist and attract a few participants in all, except possibly Chemical Engineering and Materials Science.

Item: Please indicate the extent to which you participate in the student professional engineering society in your field/department (e.g., A.S.C.E, U.C.S.E.E., etc.). [ESQ33].

TOTALS -- Engineering

11% Member, active (=1) | 2% Other | 43% Not a member

22% Member, occas. attend/partic. (=2) | 23% Member, not active

(N= 343) | Chi^2-probability = .0052*

Prog.*	Pct. 1+2	N					
EECS	25%	(73)	MSE+	29%	(24)	*XaferE	36% (22)
ChemE	27%	(52)	MechE	29%	(82)	IEOR	37% (19)
						CivilE	43% (72)
						NuclE+	48% (23)

Item: To what extent do you participate in other societies relevant to engineering: Honor society in your department/program? [ES Q34D].

TOTALS -- Engineering

12% Active (=1) | 14% Occasionally attend/partic. (=2) | 74% Not active

(N= 148)** | Chi^2-prob. = .2737*

Prog.*	Pct. 1+2	N					
ChemE	0%	(14)**	MechE	21%	(33)**	IEOR	33% (12)**
MSE+	0%	(3)**	EECS	26%	(38)**	*XaferE	33% (4)**
						CivilE	34% (32)**
						NuclE+	43% (14)**

*These responses are excluded from Totals and Chi-Sq.-prob. See Appendix A, p. A-11, for more information.
**"Not Applicable" and blank responses constitute 15% or more of prospective total for group.

Faculty Participation in the Student Professional Societies in Engineering. With 59% of the potential respondents presumably knowing enough to choose from among the 1-5 scaled response categories, students were evenly divided

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.).

(S.D. 5-23/43/25-3% S.A.) about whether there was enough faculty participation in the student professional society in their field [ESQ #4]. There were no significant differences between the program means [F-prob.= .2843], but the response in Nuclear Engineering (0-14/43/29-14) seemed a little more positive than most [e.g., the Chi-Square probability for the matrix of 5 response categories by 7 programs was .0354].

Item: There is enough faculty participation in the student professional societies in my field of engineering. [ES Q4].

TOTALS — Engineering

5% Str. Disagree, 23% Disagree, 43% In Between, 25% Agree, 3% Str. Agree

*Mean: 2.99 ± 0.13 (204)** F-probability = .2843*

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
*XsferE	2.50	±	(10)	IEOR	2.85	± 0.48	(13)	MSE+	2.92	± 0.72	(13)
EECS	2.76	0.25	(41)	ChemE	2.91	0.32	(34)	MechE	3.05	0.32	(43)
CivilE	3.11	± 0.24	(46)								
NuclE+	3.43	0.54	(14)								

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Multi-Department Professional Societies in the Engineering Departments. With 76% of the students responding (N= 276), 13% were active, or occasionally attended or participated, in the Society of Women Engineers [ESQ #34B]. The general engineering honor society (Tau Beta Pi) seemed to attract roughly the same number, with 26% of 151 respondents active or occasionally attending/participating [ESQ #34C]. Among 290 respondents, the National Society of Professional Engineers drew 6% actives plus occasionals [ESQ #34A].

Item: To what extent do you participate in other societies relevant to engineering: National Society of Professional Engineers? [ES Q34A].

TOTALS — Engineering

2% Active (=1), 4% Occasionally attend/partic. (=2), 94% Not active

(N= 290) Chi^2-prob. = .1250*

Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N
MechE	0%		(68)	ChemE	5%		(42)**	CivilE	8%		(61)
MSE+	0%		(19)	EECS	6%		(62)	*XsferE	20%		(20)
IEOR	11%		(19)	NuclE+	21%		(19)				

Item: To what extent do you participate in other societies relevant to engineering: Society of Women Engineers? [ES Q34B].

TOTALS — Engineering

4% Active (=1), 9% Occasionally attend/partic. (=2), 88% Not active

(N= 276) Chi^2-prob. = .4088*

Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N
EECS	7%		(61)	MSE+	11%		(19)	ChemE	12%		(41)**
MechE	3%		(61)**	NuclE+	12%		(17)**	IEOR	18%		(17)
*XsferE	21%		(19)	CivilE	22%		(50)				

Item: To what extent do you participate in other societies relevant to engineering: Tau Beta Pi (general Engineering honor society)? [ES Q34C].

TOTALS — Engineering

17% Active (=1), 9% Occasionally attend/partic. (=2), 74% Not active

(N= 151)** Chi^2-prob. = .2434

Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N	Prog.*	1+2	Pct.	N
IEOR	9%		(11)**	ChemE	15%		(20)**	MSE+	25%		(8)**
*XsferE	14%		(7)**	MechE	19%		(31)**	EECS	28%		(43)**
CivilE	29%		(24)**	NuclE+	57%		(14)**				

*These response are excluded from totals and Chi-sq.-prob. See Appendix A, p. A-11, for more information.
**"Not Applicable" and blank responses constitute 25% or more of prospective total for group.

Departmental Support for Student Organizations and Student Participation on Committees. A very large majority of the respondents agreed (S.D. 2-6/19/47-26% S.A.) that their program "should (even if it already does) include undergraduates on most committees, provide an office, allow a quarterly mailing, etc., to facilitate undergraduate organizing and input" [UMPEO #55]. There were no significant differences in the program ratings [F-prob.= .7106], with the range of agreement extending only from large to overwhelming majority, and disagreement only from 2% to 15%.

Item: The program should (~~even if it already does~~) include undergraduates on most committees, provide an office, allow a quarterly mailing, etc., to facilitate undergraduate organizing and input. [CMPEQ Q55.] [1979 wording: ~~(even if it already does)~~; 1977 wording, additional change: ~~organizing and input~~ organization.]

Prog.	Mean	95% Conf.	N							
NuclE+	3.60	± 0.49	(20)	Math	3.84	± 0.31	(32)	IEOR	3.90	± 0.48 (21)
MSE+	3.70	0.48	(23)	CivilE	3.86	0.24	(69)	EECS	3.93	0.67 (19)
Physic	3.75	0.37	(36)	Geol	3.86	0.44	(21)	ChemE	3.97	0.22 (59)
*HlcS77	3.84	0.10	(377)	MechE	3.86	0.21	(74)	*SHum77	3.98	0.13 (243)

TOTALS -- Engineering and Physical Sciences							
2% Str. Disagree						26% Str. Agree	
6% Disagree			19% In Between			47% Agree	
*Mean: 3.89 ± 0.08 (496)					F-probability = .7106*		
Chem	4.00	± 0.37	(31)				
*SocS79	4.08		0.09 (416)				
*XafE	4.11		0.31 (18)				
LSComp	4.14		0.24 (43)				
*XafLSC	4.21		0.41 (19)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

In the engineering departments, although only 65.6% of the respondents chose from among the 1-5 scaled response categories, a very large majority of them agreed (S.D. 1-2/20/63-14% S.A.) that committee memberships, and agenda and background materials under consideration by departmental committees, should be posted outside the program office in advance of committee meetings [ESQ #23]. Again, there were no significant differences between the program ratings [F-prob.= .5085], with agreement ranging only from very large to overwhelming majority.

Item: Committee memberships, and agendas and background materials under consideration by committees in my department/program should be posted outside the program office in advance of committee meetings. [ES Q23].

Prog.	Mean	95% Conf.	N							
ChemE	3.63	± 0.32	(38)**	EECS	3.88	± 0.19	(49)**	IEOR	3.93	± 0.14 (15)**
MSE+	3.88	0.27	(16)**	CivilE	3.93	0.19	(54)**	NuclE+	3.94	0.41 (16)**
MechE	3.94	± 0.19	(30)**							
*XafarE	4.00		(14)**							

TOTALS -- Engineering							
1% Str. Disagree						14% Str. Agree	
2% Disagree			20% In Between			63% Agree	
*Mean: 3.87 ± 0.09 (238)**					F-probability = .5085*		

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.
**"Don't Know or Not Applicable" and blank responses constitute 25% or more of prospective total for group.

In Mechanical Engineering, students were also asked whether they had the time and inclination to spend 2-3 hours per week to serve on a departmental faculty committee, and about three in eight agreed they did (S.D. 14-28/21/22-15% S.A.) [MEQ #5]. Some of the answers in the middle three response categories may, of course, be contingent on the charge of the committee on which the student might serve.

Alumni Associations in the Engineering Departments. A large majority of the respondents, albeit with perhaps less than complete enthusiasm, agreed (S.D. 4-8/20/50-18% S.A.) that they were interested in joining the engineering alumni association when they graduated [ESQ #24]. Interest varied somewhat by program [F-prob.= .0139], with Civil Engineering students (0-2/16/59-23) significantly more likely to agree than those in three or four other programs. These lower ratings, still indicative of fairly high interest in the engineering alumni association, were found in EECS (7-12/25/42-15), Mechanical Engineering (9-6/25/44-16), Chemical Engineering (2-17/21/40-19) and IEOR (0-17/11/67-6). In Materials Science (10-0/10/57-24) and Nuclear Engineering (10-0/10/57-24), interest in joining the alumni society was almost as high as in C.E.

Item: I would be interested in joining the engineering alumni association when I graduate. [ES Q24].

Prog.	Mean	95% Conf.	N							
EECS	3.47	± 0.28	(60)	ChemE	3.57	± 0.31	(47)	*XafarE	3.80	(20)
MechE	3.53	0.27	(68)	IEOR	3.61	0.42	(18)	NuclE+	3.86	± 0.30 (21)
MSE+	3.95	± 0.28	(20)	CivilE	4.05	0.17	(64)			

TOTALS -- Engineering							
4% Str. Disagree						13% Str. Agree	
8% Disagree			20% In Between			30% Agree	
*Mean: 3.69 ± 0.11 (298)					F-probability = .0139*		

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Teaching Evaluation

Distribution of Teaching Evaluation Forms. An overwhelming majority of the respondents agreed (S.D. 3-7/3/45-42%) that at least one form for student evaluation of teaching was distributed last quarter in each* of the courses in their program in which they were enrolled [UMPEQ #57]. While there were statistically significant differences between some of the program ratings [F-prob.= .0003], the differences seemed to hinge primarily on the strength* of student agreement; which in total was never below a very large majority in any program. Among the programs where the distribution of teaching evaluation forms was most clearly regular and systematic are: Geology (0-4/0/33-63), EECS (1-1/0/45-52), Physics (0-0/0/56-44) and Chemistry (0-3/6/39-53). Programs where the distribution of forms seemed more problematic include: Civil Engineering (7-15/4/38-36), Mechanical Engineering (6-11/2/48-33), Math (6-8/3/50-33), IEOR (5-10/5/40-40) and Nuclear Engineering (8-0/8/50-33). See below for table.

Use of the Primer (now SPECs) Questionnaire. An overwhelming majority of the respondents also agreed (S.D. 3-3/11/45-38% S.A.) that "all faculty should occasionally use the ASUC Primer questionnaire to evaluate their larger courses and those required for the major, so that students will have access to evaluations of faculty teaching" [UMPEQ #58]. Although the levels of agreement by program ranged only from large to overwhelming majority, there were significant differences between some of the ratings [F-prob.= .0247]. In particular, students in Mechanical Engineering seemed most likely to agree (1-0/3/48-48) while students seemed least, though still very, likely to agree in Geology (9-5/9/59-18) and Math (10-3/13/45-29).

Item: At least one form for student evaluation of teaching was distributed last quarter in each of the program's courses in which I was enrolled. [UMPEQ Q57].

TOTALS — Engineering and Physical Sciences

1% Str. Disagree, 7% Disagree, 3% In Between, 42% Str. Agree, 45% Agree

Mean: 4.17 ± 0.08 (349) F-probability = .0003

Prog.	Mean	95% Conf.	N							
*XaferE	3.55	± 0.51	(20)	Math	3.97	± 0.37	(36)	MSE+	4.20	± 0.38 (25)
*SHum77	3.31		(264)	IEOR	4.00	0.33	(20)	*HistS77	4.23	(420)
CivilE	3.82	0.29	(74)	NuclE+	4.00	0.47	(24)	ChemE	4.25	0.20 (61)
MechE	3.94	0.25	(84)	*SocS79	4.13	0.09	(463)	LSComp	4.30	0.23 (33)
*XafLSC	4.30	± 0.24	(23)							
Chem	4.42	0.25	(36)							
Physic	4.44	0.16	(39)							
EECS	4.45	0.17	(73)							
Geol	4.54	0.30	(24)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Item: All the faculty should occasionally use the ASUC Primer questionaire to evaluate their larger courses and those required for the major, so that students will have access to evaluations of faculty teaching. [UMPEQ Q58].

TOTALS — Engineering and Physical Sciences

3% Str. Disagree, 3% Disagree, 11% In Between, 38% Str. Agree, 43% Agree

Mean: 4.11 ± 0.08 (303) F-probability = .0247

Prog.	Mean	95% Conf.	N							
Geol	3.73	± 0.50	(22)	NuclE+	3.91	± 0.43	(23)	*XaferE	4.05	± 0.35 (22)
Math	3.81	0.44	(31)	Physic	3.94	0.39	(33)	*SHum77	4.07	0.12(256)
*XafLSC	3.81	0.59	(21)	*HistS77	3.99	0.09	(409)	EECS	4.09	0.23 (68)
Chem	3.86	0.42	(37)	MSE+	4.00	0.34	(22)	*SocS79	4.09	0.09(429)
IEOR	4.12	± 0.31	(17)							
ChemE	4.16	0.25	(55)							
LSComp	4.17	0.23	(47)							
CivilE	4.25	0.21	(71)							
MechE	4.42	0.15	(77)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

*See footnote "**" on page 70 regarding relative answers (response categories 2, 3, and 4) to what appear to be "absolute" or "either/or" questions such as this one (e.g., "each" of the courses).

Summary of Problems by Program: Student Participation in Program Decision-Making

This section focused on the extent to which students believe that faculty will take their views and needs into account in their decision-making for the program, student organizations and student participation in program decision-making, and teaching evaluation. In addition, engineering students (only) were asked about the extent of their participation in various departmental and interdepartmental student professional societies and the likelihood that they would joint the alumni association.

Clear Views Shared Across Programs. Students in all of the programs agreed rather strongly that their program should facilitate undergraduate organizing and input by allowing a quarterly mailing, providing an office, etc., and that there should be undergraduates on most program committees. The engineering students in the sample also agreed, again rather strongly, that departmental committee memberships, as well as agendas and background materials, should be posted publicly in advance of committee meetings. A large majority of the engineering students expressed some positive interest in joining the alumni association after they graduate.

The respondents in all programs also agreed rather strongly that all faculty should occasionally use the Primer (now SPECs) questionnaire to evaluate large and required courses.

Trust that faculty will take student needs and views into account in faculty decision-making for the program seemed/ranked lowest in Chemistry, Materials Science and L&S Computer Science. These same three departments, and especially Chemistry, had relatively less effective means of notifying their students of meetings of the general undergraduate organization in the program. — Chem LSComp MSE+

In Math, Nuclear Engineering, Mechanical Engineering and Civil Engineering, the level of student trust of the faculty (to take student needs and views into account in program decision-making) was just above a narrow plurality, and the results in EECS and IEOR were only a little better. Except for EECS, the student responses in these programs suggest that forms for student evaluation of teaching were not systematically distributed to every class. Among the engineering programs listed here, with the possible exception of Nuclear Engineering, faculty participation in the departmental professional society was not regarded as particularly sufficient, and student participation in the Mechanical Engineering and EECS societies seemed a little low. In Math, about half of the students had never received a notice of meeting of their undergraduate organization, and the notices of meeting were not fully effective in EECS either. — Math MechE EECS CivilE IEOR NuclE+

In Geology, agreement was again only by plurality that faculty could be trusted to take student needs and views into account in their decision-making for the program, and notice of meetings for the program's general undergraduate organization were not very effectively distributed. — Geol

In Chemical Engineering, student participation in the undergraduate professional society was perhaps a little low, and faculty participation in that society was not seen as particularly sufficient. — ChemE

In Physics, agreement was again only by plurality that faculty could be trusted to take student needs and views into account in their decision-making for the program. — Physic

INFLUENCES ON STUDENTS' OVERALL GROWTH AND LEARNING

Introduction/Definition

Even from the most utilitarian perspective on the goals of education in a professional school or college, as contrasted (say) with fields in letters, arts and sciences, a college education is seldom deemed adequate if it is limited to learning of skills associated with a profession and subject matter. Nor, by any stretch of the imagination, are the actual sources of learning restricted to classrooms and assigned readings and work.

One set of Undergraduate Major Program Evaluation Questionnaire (UMPEQ) items included seven, largely-separate sources of influence that students typically encounter in any college or university setting. This seven-part item asked the student to rate (via fill-in) each of the influences "on your overall growth and learning while you have been attending college at Berkeley." This wording leaves the student free to use his/her own educational and philosophical definition of growth and learning. The scale employed was somewhat different than usual, and consisted of:

1= Of very little influence
2= Somewhat influential
3= Moderately influential
4= Highly influential

The tables showing the students' responses to all seven items are shown on the following page.

Academic and Intellectual Influences

The Instructional Process. Of the seven items about what influenced them, students in the Engineering and Physical Science programs assigned the highest ratings of impact to the instructional process (including lectures, assignments, studying, faculty contact, etc.) [UMPEQ #67A]. Virtually half (49%) of the students marked the instructional process to be "highly influential"; another 36% responded "moderately influential." Twelve percent (12%) responded "somewhat influential" and only two percent (2%) chose "of very little influence." The instructional process was the first-ranked influence on students in all of the programs except Math and Geology, where it was rated almost as high as the leading influence(s). In terms of statistical significance, there were differences between some of the mean ratings [F-prob.= .0419]. As an influence, the instructional process was rated highest in Physics (V.Lit. 3/8/20/70% High),* and nearly as highly in Civil Engineering (0/5/39/55), Materials Science (0/8/36/56) and Chemical Engineering (2/10/32/56). Physics and Civil Engineering students gave statistically higher ratings to the influence of the instructional process than did students in Math (3/29/32/37).

Students' Own Intellectual Interests. The students' "own intellectual interests/pursuits (apart from any class assignments)," including their own choice of reading (etc.) was ranked fifth overall as an influence, though it was nearly as important as the third and fourth-ranked items [UMPEQ #67B]. Overall, the response percentages were: V.Lit. 11/28/33/28% High. Examined by program, the

*The figures in parentheses represent the percentages of respondents choosing each of the four response categories, ranging from "Of very little influence" to "Highly influential," as shown in the text on this page.

Item: Please rate the factors below as to their influence on your overall growth and learning while you have been attending college at Berkeley. [UCUES Q67.]

67A. The instructional process: classroom lectures, labs, class assignments (readings, homework, etc.), studying for exams, contact of all kinds with faculty, etc.

TOTALS — Engineering and Physical Sciences

2% Of very little influ. 49% Highly influential
12% Somewhat influential 36% Moderately influential
Mean: 3.33 ± 0.06 (361) F-probability = .0419

Prog.	Mean	95% Conf.	N
*YsfLSC	2.91	± 0.39	(23)
Math	3.03	0.29	(38)
*SocS79	3.07	0.08	(489)
NuclE+	3.17	± 0.37	(24)
Geol	3.19	0.30	(26)
EECS	3.22	0.21	(73)
MechE	3.24	0.19	(85)
IEOR	3.29	± 0.36	(21)
LSComp	3.33	0.19	(54)
Chem	3.35	0.23	(37)
*YsfarE	3.41	0.38	(22)
ChemE	3.44	± 0.19	(62)
MSE+	3.48	0.27	(25)
CivilE	3.50	0.14	(76)
Physic	3.58	0.24	(40)

67B. Your own intellectual interests/pursuits (apart from any class assignments); your own choice of readings; etc.

TOTALS — Engineering and Physical Sciences

11% Of very little influ. 29% Highly influential
29% Somewhat influential 33% Moderately influential
Mean: 2.78 ± 0.08 (359) F-probability = .0023

Prog.	Mean	95% Conf.	N
CivilE	2.51	± 0.22	(75)
MechE	2.53	0.22	(85)
*YsfarE	2.64	0.30	(22)
LSComp	2.67	± 0.29	(54)
ChemE	2.69	0.23	(62)
*YsfLSC	2.70	0.40	(23)
NuclE+	2.79	0.43	(24)
EECS	2.82	± 0.23	(73)
Chem	2.83	0.34	(36)
*SocS79	2.92	0.08	(490)
Geol	3.00	0.38	(25)
IEOR	3.05	± 0.37	(21)
Math	3.05	0.29	(38)
MSE+	3.08	0.36	(25)
Physic	3.20	0.28	(40)

67C. The broader University and community environment: campus and community activities of all kinds, artistic and cultural offerings, public lectures, rallies, local and ASUC politics, etc.

TOTALS — Engineering and Physical Sciences

31% Of very little influ. 15% Highly influential
32% Somewhat influential 22% Moderately influential
Mean: 2.22 ± 0.09 (332) F-probability = .3626

Prog.	Mean	95% Conf.	N
*YsfarE	1.77	± 0.43	(22)
ChemE	2.00	0.27	(62)
LSComp	2.08	0.27	(52)
NuclE+	2.08	± 0.41	(24)
Chem	2.08	0.36	(36)
EECS	2.12	0.24	(73)
*YsfLSC	2.13	0.42	(23)
Math	2.21	± 0.37	(38)
Geol	2.28	0.42	(25)
MechE	2.31	0.23	(83)
Physic	2.33	0.38	(39)
MSE+	2.36	± 0.39	(25)
CivilE	2.42	0.24	(74)
IEOR	2.57	0.51	(21)
*SocS79	2.58	0.10	(490)

67D. Developments and issues in the international, national or state arenas; the ongoing social, political, economic and human situation.

TOTALS — Engineering and Physical Sciences

34% Of very little influ. 9% Highly influential
33% Somewhat influential 24% Moderately influential
Mean: 2.09 ± 0.08 (334) F-probability = .0979

Prog.	Mean	95% Conf.	N
Chem	1.73	± 0.27	(37)
LSComp	1.91	0.24	(53)
CivilE	1.96	0.21	(74)
NuclE+	2.00	± 0.37	(24)
*YsfLSC	2.04	0.40	(23)
MechE	2.07	0.21	(83)
ChemE	2.10	0.27	(62)
EECS	2.13	± 0.24	(72)
*YsfarE	2.14	0.54	(22)
Geol	2.23	0.43	(25)
MSE+	2.24	0.38	(25)
IEOR	2.29	± 0.41	(21)
Physic	2.35	0.34	(40)
Math	2.39	0.33	(38)
*SocS79	2.78	0.09	(490)

67E. Interaction with peers (other students, roommates, friends, lovers, etc.)

TOTALS — Engineering and Physical Sciences

8% Of very little influ. 41% Highly influential
19% Somewhat influential 31% Moderately influential
Mean: 3.06 ± 0.08 (339) F-probability = .6466

Prog.	Mean	95% Conf.	N
NuclE+	2.92	± 0.41	(24)
EECS	2.93	0.22	(74)
MechE	2.94	0.21	(85)
IEOR	2.95	± 0.38	(21)
*YsfarE	2.95	0.46	(22)
LSComp	3.02	0.28	(53)
Physic	3.08	0.34	(39)
ChemE	3.10	± 0.22	(62)
CivilE	3.11	0.20	(74)
Math	3.11	0.33	(38)
Chem	3.11	0.34	(36)
*SocS79	3.17	± 0.08	(491)
*YsfLSC	3.22	0.37	(23)
Geol	3.31	0.37	(26)
MSE+	3.40	0.36	(25)

67F. Your own special efforts at self-discovery or self-development (apart from those normally likely to occur through interaction with peers).

TOTALS — Engineering and Physical Sciences

11% Of very little influ. 32% Highly influential
26% Somewhat influential 31% Moderately influential
*Mean: 2.83 ± 0.08 (338) F-probability = .0194

Prog.	Mean	95% Conf.	N
Chem	2.36	± 0.36	(36)
NuclE+	2.42	0.46	(24)
ChemE	2.77	0.27	(61)
CivilE	2.78	± 0.21	(76)
MechE	2.79	0.21	(83)
EECS	2.85	0.24	(74)
LSComp	2.89	0.26	(54)
Math	2.95	± 0.32	(38)
Geol	2.96	0.37	(26)
IEOR	3.05	0.49	(21)
*SocS79	3.06	0.09	(490)
Physic	3.11	± 0.31	(38)
*YsfarE	3.23	0.30	(22)
*YsfLSC	3.26	0.44	(23)
MSE+	3.29	0.35	(25)

67G. Other personal commitments and involvements: for example, employment, family matters, a long-term leadership role or struggle with adversity, etc.

TOTALS — Engineering and Physical Sciences

12% Of very little influ. 30% Highly influential
27% Somewhat influential 32% Moderately influential
Mean: 2.80 ± 0.08 (334) F-probability = .5139

Prog.	Mean	95% Conf.	N
Chem	2.36	± 0.37	(36)
NuclE+	2.58	0.48	(24)
Math	2.68	0.35	(37)
CivilE	2.68	± 0.22	(76)
ChemE	2.69	0.24	(61)
EECS	2.84	0.22	(73)
MSE+	2.88	0.40	(24)
MechE	2.92	± 0.23	(85)
Physic	2.92	0.32	(38)
LSComp	2.94	0.24	(53)
*YsfarE	2.95	0.50	(22)
*YsfLSC	2.96	± 0.40	(23)
Geol	2.96	0.40	(26)
*SocS79	2.99	0.09	(486)
IEOR	3.00	0.46	(21)

*These responses are excluded from the totals and F-tests. See Appendix A, p. A-11, for more information.

students' own intellectual interests/pursuits usually ranked third or fourth as an influence, but were fifth in Civil Engineering, Mechanical Engineering and, just barely so, in EECS, while they were ranked second in Physics and Math. Again there were significant differences between some of the program ratings [F-prob.= .0023]. The influence of students' own intellectual interests and pursuits was rated as significantly more important, or nearly so, in Physics (5/15/35/45%), Materials Science (4/20/40/36), Math (5/18/42/34) and IEOR (0/29/38/33) than in Civil Engineering (15/39/28/19) and Mechanical Engineering (19/29/32/20).

Interpersonal and Personal Influences

The three items dealing with the personal/interpersonal aspects of students' lives--their interaction with peers, efforts at self-discovery and self-development, and other commitments and involvements--ranked second, third and fourth, respectively, as influences on students in the Engineering and Physical Science Sample. Of the three, peers were a little more influential. There was very little difference between the means of the third and fourth (and fifth) ranked influences.

Peers. Overall, the influence of students' "interaction with peers (other students, roommates, friends, lovers, etc.)" was rated as follows: V.Lit. 8/19/31/41% High [UMPEQ #67E]. The mean response to this item very nearly approximated the response category "Moderately influential." There were no significant differences between the program ratings [F-prob.= .6466].

Self-discovery, Self-development. Across the sample, the influence of the students' "own special efforts at self-discovery or self-development (apart from those normally likely to occur through interaction with peers)" was rated as follows: V.Lit. 11/26/31/32% High [UMPEQ #67F]. By program, student efforts at self-discovery and self-development ranked from second (two instances) to fifth (three instances), and some of the inter-program differences were significant statistically [F-prob.= .0194]. Special efforts at self-discovery/development were rated as a fairly important influence in Materials Science (0/24/24/52) and only somewhat less so in Physics (5/24/26/45), and these ratings were significantly higher than one or both of those found in Chemistry (25/33/22/19) and Nuclear Engineering (21/42/13/25).

Other Commitments and Involvements. Overall, the influence of students' "other personal commitments and involvements," including "employment, family matters, a long-term leadership role or struggle with adversity, etc." were rated as follows: V.Lit. 12/27/32/30% High [UMPEQ #67G]. By program, the ratings were not significantly different from one another [F-prob.= .5139].

Influences in the Broader Sociocultural Environment

The University and Community Environment. Clearly, the lowest rated influences on students in the Engineering and Physical Sciences were those in the environment at large. Ranked sixth overall, and well below the fifth-ranking influence on students, was the broader University and community environment, including "campus and community activities of all kinds, artistic and cultural offerings, public lectures, rallies, local and ASUC politics, etc." [UMPEQ #67C]. The overall response was: V.Lit. 31/32/22/15% High, and there were no differences between the program ratings [F-prob.= .3626].

The Broader Human Situation. The lowest-ranked influence on students in the sample was "developments and issues in the international, national or state arenas; the ongoing social, political, economic and human situation" [UMPEQ #67D]. The mean response here very nearly approximated the response category, "Somewhat influential." For the entire group, the percentage distribution of the responses was: V.Lit. 34/33/24/9% High. By program, developments in the broader social-political-economic-human sphere usually ranked seventh, though they ranked sixth in a third of the programs. Although the confidence intervals of the means for Math (24/26/37/13) and Physics (25/35/20/20) did not overlap with that of Chemistry (49/30/22/0), these differences were of borderline reliability [F-prob.= .0979].

Comparison Data

Since the seven-part item concerning the influences on students' lives was not in use before 1978, comparative data exists only for the Social Science-related programs and lower division students (in all five colleges). It is not clear, of course, what, if any, would be an ideal pattern of response for any particular program's students. Compared to the responses of lower division students in the College of Engineering, the influence of the instructional process was a little higher among the upper division students in the College, but there were no other significant differences. In the College of Chemistry, there were two main differences--the instructional process was a little more influential at the upper division level, and the students' own special efforts at self-discovery/development were of greater influence among the lower division students.

As might be expected, the differences between the Engineering and Physical Science Sample and the Social Science-related Sample were more marked: 1) the instructional process was slightly more influential among the Engineering and Physical Science students; 2) the broader University and community environment was somewhat more influential for Social Science students, with their average response being ranked above all 12 Engineering and Physical Science programs; 3) developments and issues in the social, political, economic and human situation, from the State to the international levels, were much more influential to students in the Social Sciences, with the Social Science mean being rated significantly above the means of almost all of the Engineering and Physical Science programs; 4) students' own special efforts at self-discovery or self-development were slightly more influential among Social Science students; and 5) students' other personal commitments and involvements were slightly more influential for Social Science students.

OVERVIEW OF DEPARTMENT/PROGRAM CONTRIBUTIONS

Introduction and Crossreferences

One section of the Undergraduate Major Program Evaluation Questionnaire (UMPEQ) divided the principal, possible goals of a college/university education into six components and asked the Engineering and Physical Science students to

rate the importance of each goal and also their program's contribution to each goal. From these ratings, one can ascertain the students' desired emphasis on each goal in each of the programs (see Appendix A, pages A-3, A-7), their assessment of the program's contribution to that goal, and the difference between the two. In the calculation of the difference between the two, the mean rating of the importance to the student of each goal can be subtracted from the mean rating for the program's contribution toward meeting each goal. Though one cannot expect perfection in real life, the difference or "deficit" between the two means ("Program's contribution" minus "Importance to you") suggests, from the students' perspective, the extent of underemphasis on each goal within the program or, alternatively, the extent to which the program's delivery system(s) is (are) not fully effective.

In the rating of "Importance to you" and "Program's contribution," the students were asked to use the following scale (for all six goals):

1= Very Low
2= Low
3= In Between
4= High
5= Very High

The section following below discusses the students' ratings of their "Program's contribution" to each of six goals of a college/university education, and the differences between these ratings and their ratings of "Importance to you." For each program and for the sample as a whole, these differences (or "deficits") are depicted in a profile on page 86.

Crossreferences. There are several ways to examine the "overall" contribution of the educational process at UCB. This report has already considered general ratings of programs on the challenge, quality and motivational impact of faculty teaching (page 20), the interest and challenge of coursework (page 13), students' likely retention of material learned (page 57), and the influence of the instructional process as a whole (page 76). The most global measure, overall student satisfaction with their academic major program, is treated subsequently (page 89). Evaluations of goals specific to Civil Engineering are shown on page 59.

The Subject Matter

Overall, a large majority of the respondents felt that their program made a high contribution (V.Low 1-6/29/44-21% V.High)* to the goal of "gaining a thorough understanding of the subject matter" [UMPEQ #66F].. This goal was one of four where the Engineering and Physical Science Sample gave fairly positive ratings of approximately the same magnitude (3.66 to 3.84) to their programs. While ratings were fairly high in all the programs and the pattern of mean responses suggested that there were no significant differences between the ratings [F-prob.= .1527], the confidence interval for Physics (0-3/18/45-35), where an overwhelming majority gave high ratings, did not quite overlap with those for Mechanical Engineering (2-9/30/41-17) and Chemical Engineering (3-6/32/40-18), where only a majority marked either of the two highest responses.

With reference to the differences between the students' ratings of the importance of gaining a thorough understanding of the subject matter and the ratings of

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Very Low" (V.Low) and "Low" [slash], through "In Between" [slash], to "High" and "Very High" (V.High).

their program's contribution to that goal, the average "deficit" for the Engineering and Physical Science programs as a whole was moderate in size--0.70 points, or 17.5% of a 1-5 scale. Apart from IEOR (5% deficit), where the rating was relatively low as to the importance of gaining a thorough understanding of the subject matter, the differences (mean "Program's contribution" minus mean "Importance to you") seemed to vary little between programs, with a 13% deficit in Chemistry and 15-21% otherwise, peaking in EECS and Mechanical Engineering.

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Gaining a thorough understanding of the subject matter. [UMPEQ Q66F].

TOTALS — Engineering and Physical Sciences

1% Very Low, 6% Low; 29% In Between; 21% Very High, 44% High

Mean: 3.77 ± 0.07 (563) F-probability = .1527

Prog.	Mean	95% Conf.	N							
MechE	3.62	± 0.21	(86)	Math	3.71	± 0.25	(38)	NuclE+	3.75	± 0.34 (24)
ChemE	3.63	0.24	(52)	*XaferE	3.71	0.48	(21)	MSE+	3.76	0.27 (25)
IEOR	3.67	0.46	(21)	*XafLSC	3.74	0.42	(23)	Geol	3.77	0.43 (26)
EECS	3.70	0.23	(74)	*SocS79	3.75	0.08	(485)	CivilE	3.82	0.17 (76)
LSComp	3.83	± 0.24	(54)							
Chem	4.05	0.27	(37)							
Physic	4.13	0.25	(40)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

The reader is again reminded of the related material concerning teaching (page 20), coursework (page 13), and retention of material learned (page 57).

"Liberal Arts" Educational Goals

In addition to the concern for the coverage/understanding of the content of the discipline in which the student is majoring, there are a number of goals of a "liberal" education that typically are a concern of educators and students, if not also of faculty and administrators. Three items--which could have been elaborated further in some instances--were developed to address the principal concerns in a "liberal arts" education.

Training in Critical Thinking and Analysis. Of the three liberal arts-related items, the goal of "providing training in critical thinking and analysis" received easily the highest ratings, with a large majority responding that their program's contribution was high (V.Low 1-6/24/45-24% V.High) [UMPEQ #66D]. While the ratings for all the programs tended to be fairly high, there were statistically significant differences between at least two of the means [F-prob.= .0173]. The least positive assessments of their program's contribution to critical thinking and analysis occurred in Nuclear Engineering (4-22/22/30-22), with EECS (1-7/32/49-11) and Mechanical Engineering (4-11/24/42-20) only a shade higher, and with L&S Computer Science (0-8/25/48-19) at a slightly higher step; the remaining programs occupied the next tier, with Math highest (0-3/22/38-38).

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Providing training in critical thinking and analysis. [UMPEQ Q66D].

TOTALS — Engineering and Physical Sciences

1% Very Low, 6% Low; 24% In Between; 24% Very High, 45% High

Mean: 3.84 ± 0.07 (553) F-probability = .0173

Prog.	Mean	95% Conf.	N							
NuclE+	3.43	± 0.32	(23)	EECS	3.62	± 0.19	(73)	*XafLSC	3.83	± 0.43 (22)
*XaferE	3.45	0.34	(20)	MechE	3.64	0.23	(84)	MSE+	3.92	0.29 (25)
*SRum77	3.58	0.14	(271)	*SocS79	3.78	0.09	(487)	ChemE	3.94	0.23 (62)
*HltS77	3.59	0.09	(421)	LSComp	3.79	0.24	(52)	CivilE	3.96	0.18 (74)
Geol	3.96	± 0.30	(25)							
Chem	4.00	0.27	(37)							
Physic	4.00	0.28	(40)							
IEOR	4.00	0.35	(21)							
Math	4.11	0.28	(37)							

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

For the entire sample, the difference was modest (12% of a 1-5 scale) between the students' ratings of "Program contribution" and [minus] "Importance to you," for the goal of obtaining "training in critical thinking and analysis." By program, "deficits" ranged from 5% in Civil Engineering to a moderate 22% in Nuclear Engineering, with the second-highest deficits in EECS (17%) and Mechanical Engineering (16%).

A Broad, General, Humanistic or Person-centered Education. The wording of this item combines several related goals of a college education into one--providing or obtaining "a broad, general, humanistic or person-centered education." The Engineering and Physical Science programs were not rated as providing much in the way of a broad, general education, with a large plurality seeing their contribution as low (V.Low 12-34/39/13-2% V.High) [UMPEQ #66C]. (It is not possible to tell the extent to which the respondents' ratings focused on their own departmental offerings here, as contrasted with their entire or upper division program--but see the second paragraph following.) There were no statistically significant differences between the program ratings [F-prob.= .4148], with the responses ranging from a slight plurality on the high side (0-25/45/30-0, in IEOR) to a majority on the low side (22-35/26/17-0, in Nuclear Engineering).

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Providing a broad, general, humanistic or person-centered education. [UMPEQ Q66C].

Prog.	Mean	95% Conf.	N							
*XsfarE	2.35	± 0.46	(20)	MSE+	2.57	± 0.48	(23)	ChemE	2.59	± 0.24	(61)	*HltS77	2.74	± 0.10	(399)
NuclE+	2.39	0.45	(23)	*XsfLSC	2.57	0.39	(23)	Chem	2.63	0.31	(35)	Geol	2.87	0.40	(23)
MechE	2.46	0.21	(52)	LSComp	2.58	0.25	(52)	Physic	2.66	0.34	(38)	IEOR	3.05	0.36	(20)
Math	2.48	0.39	(33)	CivilE	2.58	0.20	(74)	EECS	2.72	0.19	(71)	*Shum77	3.33	0.14	(267)
												*SocS79	3.66	0.10	(483)

TOTALS — Engineering and Physical Sciences

12% Very Low, 34% Low, 39% In Between, 13% High, 2% Very High

Mean: 2.61 ± 0.08 (333) F-probability = .4148

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

The differences between the "ideal" and "actual" mean ratings of the goal of obtaining "a broad, general, humanistic or person-centered education" were fairly substantial in the Engineering and Physical Science Sample, with an average deficit spanning 27% of a 1-5 scale. Interestingly enough, neither the program ratings of "Importance to you" nor of "Program's contribution," nor the differences between them, showed any particular relation to their status of belonging to L & S as contrasted with either professional college. The deficits ranged from 17% in Geology, with Chemistry, Nuclear Engineering and EECS on a second tier at 22%, and otherwise 25% or more, to a peak of 33% in L&S Computer Science.

While these indicators appear to reflect a fairly substantial underemphasis in almost all the programs on the goal of providing a broad, general or humanistic education, interpretation of these results may differ according to current expectations and practices in "professional" as contrasted with "academic" programs. However, in accord with the results of the "deficit" analysis, it is instructive to note that the engineering students, perhaps apart from those in Nuclear Engineering, were not particularly amenable to reduction in the number of units required in social science and humanities courses (page 52).

Social Responsibility and Skills Useful in the Community. Half of the students in the sample rated as low their program's contribution to the goal of "promoting social responsibility or developing skills useful in the community," and only one in six rated that contribution as high (V.Low 17-33/33/14-3% V.High) [UMPEQ #66E]. The highest ratings, with an equal number of high and low responses regarding their program's contribution to promoting social responsibility or

developing skills useful in the community, were found in Civil Engineering (11-23/32/27-7%). With large pluralities to a large majority giving low ratings, the following programs tended to be significantly below Civil Engineering: Math (50-27/23/0-0), Nuclear Engineering (9-55/27/5-5), EECS (11-47/31/9-1), Mechanical Engineering (23-28/30/17-1), Physics (20-29/40/9-3) Chemistry (16-38/34/6-6), L&S Computer Science (22-28/28/20-2) and Materials Science (9-39/39/13-0) [F-prob.= .0000]. And Math was rated significantly lower than almost all of the other programs.

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Promoting social responsibility or developing skills useful in the community. [UMPEQ Q66Z].

TOTALS — Engineering and Physical Sciences

17% Very Low
33% Low
33% In Between
14% High
3% Very High

Mean: 2.55 ± 0.09 (524) F-probability = .0001

Prog.	Mean	95% Conf.	N									
Math	1.73	± 0.31	(30)	EECS	2.43	± 0.20	(72)	LSComp	2.52	± 0.32	(50)	
*SHum77	2.22		0.13(222)	MechE	2.45		0.23 (82)	MSE+	2.57		0.36 (23)	
*XsfLSC	2.33		0.51 (21)	Physic	2.46		0.35 (35)	*HltS77	2.59		0.11(376)	
NuclE+	2.41		0.40 (22)	Chem	2.50		0.38 (32)	*XsfarE	2.67		0.51 (21)	
ChemE	2.70	± 0.26	(61)									
Geol	2.74		0.46 (23)									
IEOR	2.80		0.49 (20)									
CivilE	2.96		0.26 (74)									
*SocS79	3.25		0.11(439)									

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

The difference between the mean student ratings of "Program's contribution" and "Importance to you" for the goal of "promoting social responsibility or developing skills useful in the community" was larger than that found for any of the other five goals. The difference or "deficit" spanned 30% of a 1-5 scale. For the individual programs, the smallest "deficit" or underemphasis was a moderate-sized 20% in Physics. On the other hand, the deficit in Math was little short of immense (49%). The deficit was also very substantial in Mechanical Engineering (37%) and Materials Science (36%). In the middle-ranked eight programs, where deficits were fairly substantial to substantial, the underemphasis on promoting social responsibility or developing skills useful in the community ranged from 24% to 32%. As a factor in these results, student ratings of the importance of this goal tended to be low in Physics (and somewhat so also in Nuclear Engineering and possibly EECS), and they tended to be high in Materials Science, IEOR, Chemical Engineering, Mechanical Engineering and Civil Engineering. Thus the greatest underemphasis ("deficit") occurred in Math, where the program's contribution was extremely low and the importance to the students was about average for the group as a whole, while Mechanical Engineering and Materials Science had moderately low ratings of program contribution but the goal was of high importance to many students.

Since this item may be related to those concerning whether the faculty put enough emphasis in their teaching on social issues (page 20), whether courses are available in which the contributions of the nondominant schools of thought are explored (page 9) and, only in the engineering departments, whether faculty should put more emphasis on social responsibility and ethics related to the profession and its practice (page 20), the reader may wish to review those results.

Preparation for Advanced Training and for Careers

Graduate or Professional School. Across the Engineering and Physical Science Sample, meeting student needs for preparation for graduate or professional school was one of the four strongest areas of program contribution [UMPEQ #66B]. A very large majority of the respondents gave high ratings (V.Low 2-7/21/47-23% V.High) to their program's contribution to this goal. Although the percentage of high ratings never fell below a majority in any program, there were some statistically

significant differences between some of the ratings [F-prob.= .0242]. Program contributions to preparation for graduate or professional school tended to be higher in Physics (3-0/13/51-33%), Nuclear Engineering (0-0/25/46-29), Geology (0-4/12/60-24) and Math (0-0/19/59-22) than in Chemical Engineering (5-13/25/38-18).

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Preparation for graduate or professional school. [UMPEQ Q66B].

TOTALS — Engineering and Physical Sciences

2% Very Low
7% Low
21% In Between
23% Very High
47% High

Mean: 3.82 ± 0.08 (515) F-probability = .0242

Prog.	Mean	95% Conf.	N
*SHum77	3.25	± 0.15	(254)
*Soc579	3.41	0.09	(455)
ChemE	3.51	0.30	(35)
*Hist77	3.61	0.10	(404)
EECS	3.64	± 0.24	(66)
LSComp	3.65	0.29	(46)
IEOR	3.71	0.38	(21)
MechE	3.75	0.22	(73)
*XafLSC	3.78	± 0.39	(23)
*XsforE	3.80	0.39	(20)
MSE+	3.84	0.37	(25)
Chem	3.91	0.35	(33)
CivilE	3.96	± 0.21	(71)
Math	4.03	0.22	(37)
Geol	4.04	0.30	(25)
NuclE+	4.04	0.32	(24)
Physic	4.13	0.27	(39)

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

Overall, there was no differential between the ratings of the programs' contributions to preparation for graduate or professional school and the importance of this goal to the respondents. Although there were significant differences between the ratings of the importance of this goal to students in several of the programs (and between some of the program contribution ratings), the programs' emphases on preparation for graduate or professional school generally seemed to be in good balance with their own students' interests. The range of deficits was from 10% of a 1-5 scale (in Chemistry, where the "Importance to you" ratings were second-highest) to a surplus or possible overemphasis of 14% (in Geology, where importance ratings were relatively low). A possible overemphasis by 10% was also found in Mechanical Engineering, but the differences in means otherwise fell into a narrow range of plus-or-minus 6%.

The reader is also referred to the discussion of the sufficiency of information provided by the students' programs about graduate and professional schools, and about whether engineering students know enough now to decide when and whether to go to graduate school (page 63). In addition, the respondents' long-term educational expectations (degree goals) are discussed in Appendix A (page A-6).

Preparation for a Career. A large majority of the students also rated their program's contribution as high to "preparation for a career" (V.Low 2-9/28/45-17% V.High)[UMPEQ #66A]. This goal was one of the four met most effectively by the programs. The contribution ratings were lowest in the L & S departments, especially in Math, where a plurality rated the contribution as low (9-26/34/31-0), but also in Geology (12-12/28/36-12) and Physics (8-15/38/21-18), where only a plurality gave high ratings. Math was rated significantly lower than seven of the 11 other programs, while Geology and Physics were rated lower than at least one or two others [F-prob.= .0000]. The highest ratings of program contribution to students' preparation for a career were found in Civil Engineering (0-1/23/52-24), Materials Science (0-4/33/33-29), L&S Computer Science (0-6/22/52-20), Chemical Engineering (0-5/33/41-21), Chemistry (3-6/23/51-17), EECS (1-4/25/62-7) and Mechanical Engineering (0-10/29/43-18).

The average deficit between the students' mean ratings of "Program's contribution" and "Importance to you" was moderate in size, spanning 18% of a 1-5 scale. Since the importance and contribution ratings both differed by program, the calculation of the "deficits" may be especially useful to identify programs which may underemphasize preparation for a career. The greatest deficits were found in Geology (28%) and Nuclear Engineering (25%), and moderate deficits (from 21% to

18%) were also found in Mechanical Engineering, EECS, L&S Computer Science, Civil Engineering, Physics, IEOR and Chemical Engineering. Deficits were lowest in Math (9%), Chemistry (11%) and Materials Science (11%).

Item: To what extent are the following goals important to you, and to what extent has your major program met them? Program's contribution: Preparation for a career. [UMFEQ Q66A].

TOTALS — Engineering and Physical Sciences

2% Very Low
9% Low
28% In Between
17% Very High
45% High

Mean: 3.66 ± 0.08 (331) F-probability = .0000

Prog.	Mean	95% Conf.	N								
*SHum77	3.44	± 0.14	(266)	Geol	3.24	± 0.30	(25)	MechE	3.69	± 0.19	(87)
Math	2.89	0.33	(35)	Physic	3.26	0.38	(39)	EECS	3.69	0.17	(71)
*SocS79	3.07	0.10	(460)	NuclE+	3.58	0.43	(24)	Chem	3.74	0.32	(35)
*HltS77	3.08	0.11	(406)	IEOR	3.62	0.44	(21)	ChemE	3.79	0.21	(61)
*XsrLSC	3.33	± 0.45	(23)								
LSComp	3.87	0.22	(54)								
MSE+	3.88	0.38	(24)								
CivilE	3.99	0.17	(75)								
*XsferE	4.00	0.35	(21)								

*These responses are excluded from the totals and F-prob. See Appendix A, p. A-11, for more information.

Considerable additional information about students' career-related concerns and interests can be found in two other sections of this report. One deals with whether the students have enough information about careers accessible to the holder of the bachelor's degree, as well as with registration requirements (if any) in the engineering departments (pages 64-67), while the other looks at career goals from several perspectives (see Appendix A, pages A-6 -A-10).

Summary of Problems by Program: Overview of Program Contributions

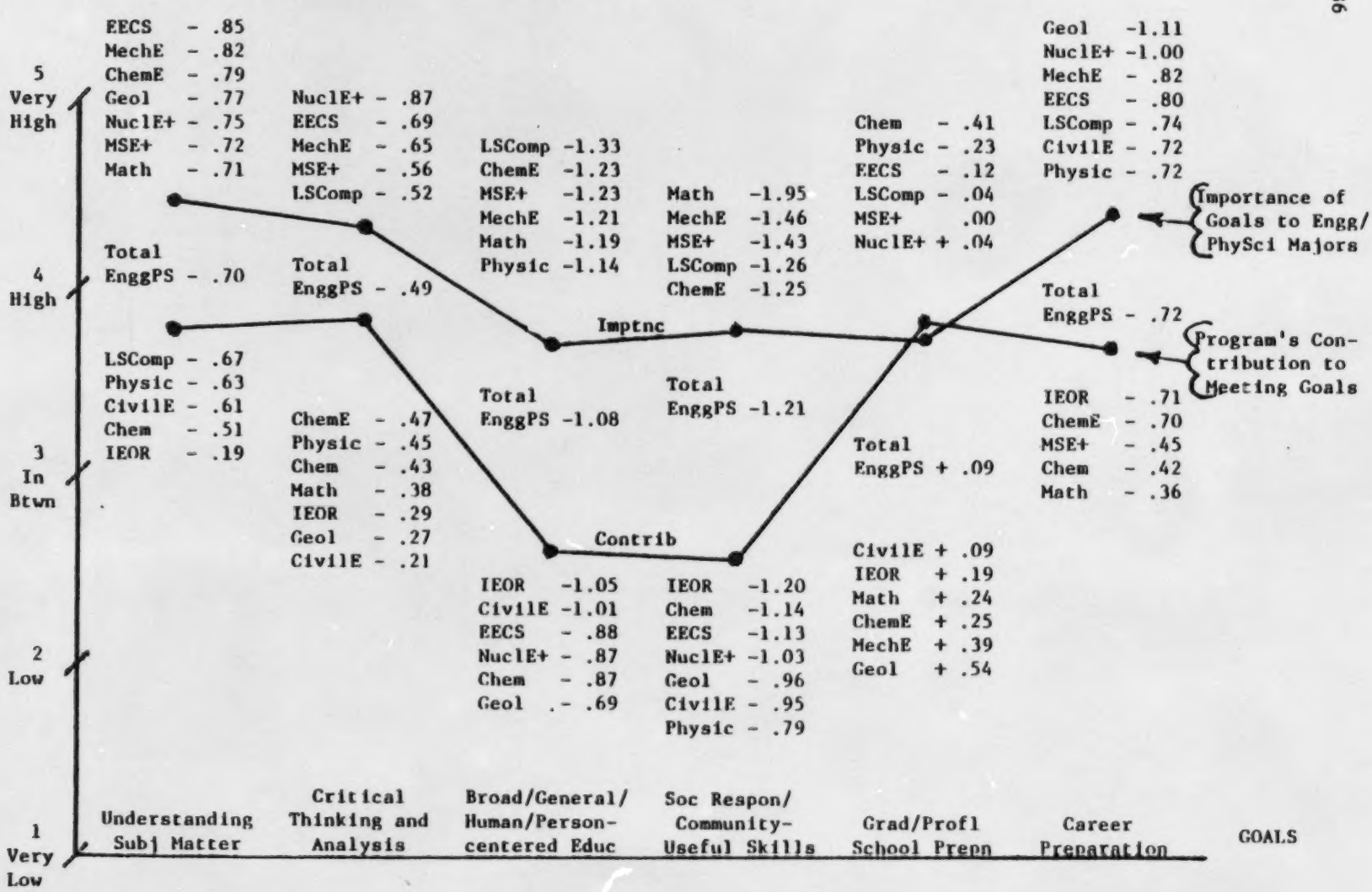
This section dealt with six goals representing the primary reasons why students attend a college or university. These goals include learning a subject matter; the traditional "liberal arts" (critical thinking and analysis: a broad, general education; social responsibility and skills useful in the community): and the pursuit of a profession, either directly or by preparing for graduate or professional school.

The focus here was not only on the student ratings of their program's contribution to the six goals, but also on the difference between the mean ratings of that contribution and the mean ratings for the importance of the goals to the respondents. This difference has been termed "deficit" and is assumed to represent the extent of underemphasis or ineffectiveness in delivery within the program. In view of the differing goals and expectations between some of the programs (e.g., in the L & S as contrasted with the engineering departments), greater attention is paid to the deficits than the ratings of "Program's contribution" in the summary which follows. While interpretation of the data is tied to values in either case, the use of the deficits allows the judgments to be based on the students' own relative valuation of each of the goals. In the text which follows, the deficits are rendered as a percentage of a scale of 1-5 length. The proper interpretation of these percentages is also imprecise, but, with a 25% deficit (1.00 mean points), for example, it seems to us that a likely interpretation would be that the students feel the program should put 25% more emphasis on a particular goal than it currently does. (Thus an 18% greater need for emphasis, or program effectiveness, on "preparation for a career" may require more additional commitment in Civil Engineering than in Physics.)

The wording used to describe the extent of the deficits between the contribution of a program to a goal and the importance given to that goal by students is systematic, as follows:

09-15% deficit: "modest"
16-22% deficit: "moderate"
24-26% deficit: "fairly substantial"
28-33% deficit: "substantial"
36-37% deficit: "very substantial"
49% deficit: "immense"

PROFILE OF MEAN RATED IMPORTANCE TO ENGINEERING AND PHYSICAL SCIENCE MAJORS OF SIX EDUCATIONAL GOALS AND OF BERKELEY'S PROGRAM CONTRIBUTION TOWARD MEETING THESE GOALS; AND DATA BY PROGRAM ON DIFFERENCES: (CONTRIBUTION) MINUS (IMPORTANCE)



Math LSComp Physic Geol

The L & S Programs. In the area of liberal arts goals, there was a substantial underemphasis on or ineffectiveness in providing a broad, general, humanistic or person-centered education in Math (30%), L&S Computer Science (33%) and Physics (29%), while the underemphasis/ineffectiveness in Geology (17%) was only moderate. Under-realization of the goal of promoting social responsibility or developing skills useful in the community was immense in Math (49%); it was substantial in L&S Computer Science (32%); and it was moderate to fairly substantial in Geology (24%) and Physics (20%). (With 7-13% deficits, training in critical thinking and analysis was reasonably successful in all four programs.)

In all four programs, a "thorough understanding of the subject matter" seemed to be conveyed with only a moderate degree of ineffectiveness (16-19%).

No more than a plurality of the students in the three L & S departments regarded as high their program's contribution to preparation for a career, with Math lowest, followed by Physics and Geology (while 72% gave high ratings in L&S Computer Science). Nevertheless, when considered in light of the level of importance placed by students on this goal (and the ordering of the "importance" ratings was the same), only in Geology was the under-realization substantial (28%). Underemphasis on/ineffectiveness in career preparation in L&S Computer Science and Physics was more moderate (18-19%), and for Math it was quite modest (9%). The Geology program perhaps put a modest overemphasis (+14%) on preparation for graduate or professional school, while the other programs were very close to evenly balanced in this regard.

MechE MSE+

College of Engineering Programs. The goal of promoting social responsibility or developing skills useful in the community was very substantially under-realized in Mechanical Engineering and Materials Science (36-37%). In both, there was also a substantial under-realization (30-31%) in providing a broad, general, humanistic or person-centered education. "Deficits" in the provision of training in critical thinking and analysis were modest (14-16%).

The degree to which the program enabled students to obtain a thorough understanding of the subject matter was moderately less than effective, 21% in Mechanical Engineering and 18% in Materials Science.

Mechanical Engineering students also wanted a moderately (21%) greater emphasis on or effectiveness in preparing them for a career, while under-realization in Materials Science was modest (11%).

NuclE+ EECS

With the respondents giving relatively low ratings of importance and of program contributions, underemphasis on or ineffectiveness in promoting social responsibility or developing skills useful in the community was just short of substantial in Nuclear Engineering and EECS (26-28%). With relatively low (Nuclear Engineering) and middle-level (EECS) ratings, for both "importance" and "program contribution," a moderate under-realization (22%) was seen as regards the goal of providing a broad, general, humanistic or person-centered education. "Training in critical thinking and analysis" was also moderately under-realized in Nuclear Engineering (22%) and EECS (17%).

Slippage also appeared to be moderate (19-21%) in enabling these students to obtain a thorough understanding of the subject matter.

Preparation for a career was fairly substantially under-realized in Nuclear Engineering (25%) and more moderately so in EECS (20%).

IEOR — With relatively high ratings of both "importance" and "program contribution," students in IEOR indicated that there was a substantial (30%) under-realization in "promoting social responsibility or developing skills useful in the community." And with both ratings again high, there was also a fairly substantial under-realization in "providing a broad, general, humanistic or person-centered education" (26%).

Also in IEOR, there was a moderate underemphasis on or ineffectiveness in preparing students for a career (18%).

CivilE — The under-realization in Civil Engineering in promoting social responsibility or developing skills useful in the community, and on providing a broad, general, humanistic or person-centered education was (only) fairly substantial (24-25%).

A thorough understanding of the subject matter seemed to be conveyed with (only) a modest to moderate degree of ineffectiveness (15%).

Under-realization of the goal of preparing students for a career was moderate too (18%).

ChemE
Chem — College of Chemistry Programs. There was a substantial under-realization in Chemical Engineering (31%) and Chemistry (29%) on promoting social responsibility or developing skills useful in the community. Substantial under-realization on providing a "broad, general, humanistic or person-centered education" was found in Chemical Engineering (31%), but deficits were more moderate in Chemistry (22%).

Regarding whether students were gaining a thorough understanding of the subject matter, the results in Chemical Engineering were indicative of moderate ineffectiveness (20%) while those in Chemistry were modest (13%).

There was an under-realization of moderate extent (18%) on the goal of preparing students for a career in Chemical Engineering; deficits were again modest in Chemistry (11%).

OVERALL SATISFACTION

Introduction and Crossreferences. The two items discussed in this section focus on the students' ratings of their overall satisfaction with their major program and with their total experience while at Berkeley. These items provide the single-most comprehensive picture of the assessments of the students in the 12 Engineering and Physical Science programs--about their major program, and about life as a student at Berkeley. Another set of items related to the questions about overall satisfaction provide information about the overall influence of the instructional process as well as six other possible sources of impact on students' overall growth and learning (pages 76-79). Other items related primarily to the question about satisfaction with the major program, each somewhat less comprehensive in nature, include those concerned with program contributions to six of the principal goals of a college or university education (pages 79-88), the quality and challenge of the teaching (page 20), the interest and challenge of the coursework (page 13), and the likelihood of retention of material learned (page 57).

Overall Satisfaction with the Major Program

To elicit the most comprehensive assessment of their programs, students were asked, "All in all, how satisfied have you been to date with your major program (faculty, teaching, advising, courses/curriculum, testing-grading, governance, etc.)?" [UMPEQ #69].

In response, students were asked to use the following scale:

1= Very dissatisfied
2= Dissatisfied
3= Somewhat dissatisfied
4= Neutral or mixed feelings
5= Somewhat satisfied
6= Satisfied
7= Very satisfied

Overall, a large majority of the respondents were satisfied enough to choose one of the three highest response categories (V.dissat. 3-5-10/12/19-37-13% V.sat.).* Regarded other ways, the mean respondent was very nearly the equivalent of "Somewhat satisfied"; the median respondent was halfway between "Somewhat satisfied" and "Satisfied"; and the modal respondent was "Satisfied."

Item: All in all, how satisfied have you been to date with your major program (faculty, teaching, advising, courses/curriculum, testing-grading, governance, etc.)? [UMPEQ Q69.] [1977 wording: "Please rate your overall level of satisfaction with your major program (. . . testing-grading. . .)." 1977 scale: Extremely Low, Low, Moderately Low, In Between, Moderately High, High, Extremely High.]

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
***SHum77	4.48	± 0.18	(272)	ChemE	4.61	± 0.46	(62)	MechE	4.99	± 0.34	(87)	NuclE+	5.21	± 0.60	(24)
*XsfarE	4.55	0.71	(22)	*EngS77	4.74	0.13	(420)	Math	5.01	0.49	(33)	CivilE	5.25	0.28	(73)
*XsfLSC	4.57	0.68	(23)	EECS	4.84	0.25	(74)	MSE+	5.04	0.59	(25)	Chem	5.27	0.53	(37)
IEOR	4.57	0.89	(21)	LSComp	4.89	0.41	(33)	*SocS79	5.09	0.15	(490)	Physic	5.40	0.43	(40)
												Geol	5.46	0.77	(26)

TOTALS — Engineering and Physical Sciences

1% Very dissatis. 13% Very satisfied
5% Dissatisfied 37% Satisfied
10% Somewhat dissat. 12% 19% Somewhat satis.
Neutral or mixed feelings

Mean: 5.02 ± 0.13 (362) F-probability = .1802

***The "selection" in the Selected Humanities sample may be relevant to these results (as on other items also). The means, confidence intervals, and number of respondents for each of the Humanities departments on this item were as follows: Spanish, 3.52 ± 0.44 (46); Practice of Art, 3.80 ± 0.63 (25); Music, 4.38 ± 0.62 (34); German, 4.42 ± 0.57 (12); History of Art, 4.57 ± 0.36 (61); French, 4.62 ± 0.47 (26); Misc. Humanities, 5.12 ± 0.45 (34); and History, 5.47 ± 0.42 (34). The Miscellaneous Humanities sample consists of: Complit (3), DramArt (1), English (20), Hum. Fld Maj. (2), Philos (3), Rhet (4), Religious Studies (1). Thus the group is composed 60% of English majors.

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

When analyzed by program, there were no significant differences between any of the mean ratings [F-prob.= .1802], and all of the confidence intervals overlapped at least a little bit. In terms of percentages, the patterns of response varied from those in which (only) a majority was satisfied, such as observed for IEOR (10-10-10/19/5-33-14) and Chemical Engineering (6-10-15/10/16-32-11) to those in which very large or overwhelming majorities were satisfied, such as observed in Geology (4-8-12/0/12-23-42) and Physics (3-3-5/3/35-35-18). With Chemistry and Civil Engineering ranking immediately below the two highest-ranked programs, all three colleges are represented among the four top-ranked programs. And, with EECS ranked third-to-last, all three colleges are also represented among the three lowest-ranked programs.

*The figures in parentheses represent the percentages of respondents choosing each of the seven response categories, as shown in the text, with slashes separating into groups the students who are dissatisfied, have neutral or mixed feelings, or are satisfied.

While none of these ratings are particularly weak in comparison to the worst ratings found in other ARU samples, none are especially stellar either. The ratings observed for the highest-ranked programs just begin to attain a level that might be termed "fairly good," while the lowest might be called "adequate" (at most). For comparative purposes, considering only the sample where exactly the same item wording and scale was used (the 14 Social Science programs), three programs rated a little below any observed in Engineering and the Physical Sciences, and two others placed very near to IEOR and Chemical Engineering; however, four Social Science programs also rated somewhat above any of the 12 in Engineering and the Physical Sciences. The results of the responses of students in 45 different undergraduate major programs* to the item about overall satisfaction with their major are shown on the following page.

Overall Satisfaction with the Total Experience at UCB

The broadest item of any in the questionnaire dealt with the respondents' overall satisfaction to date with their "total experience while at Berkeley" [UMPEQ #68]. On the same 7-point scale noted above, the students were somewhat more positive toward their total experience than toward their major program, with a very large majority being satisfied with their total experience (V.dissat. 2-4-8/11/14-37-24% V.sat.). Again there were no differences between the mean ratings from students in any of the programs [F-prob.= .2134]. The patterns of response ranged from a low of about 60+% satisfaction, such as observed for Chemical Engineering (5-8-13/11/13-27-23) and Geology (4-4-8/23/15-23-23), to highs well upwards of 80%, such as observed for students of Physics (3-5-0/8/8-46-31), Chemistry (0-3-6/6/19-39-28) and Civil Engineering (0-3-7/9/12-45-24).

Item: All in all, how satisfied have you been to date with your total experience while at Berkeley? [UMPEQ Q68.]

TOTALS — Engineering and Physical Sciences

2% Very dissatis. 24% Very satisfied
4% Dissatisfied 37% Satisfied
8% Somewhat dissat. 11% 14% Somewhat satis.
Neutral or mixed feelings

Mean: 5.38 ± 0.12 (561) F-probability = .2134

Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N	Prog.	Mean	95% Conf.	N
*MatLSC	4.63	± 0.90	(23)	MachE	5.28	± 0.34	(87)	*Socs79	5.39	± 0.14	(490)	CivilE	5.63	± 0.29	(75)
*MatarE	4.68	0.66	(22)	MSE+	5.28	0.70	(25)	IEOR	5.43	0.91	(21)	Chem	5.69	0.43	(36)
ChemE	4.92	0.47	(62)	NuclE+	5.29	0.69	(24)	Math	5.47	0.41	(38)	Physic	5.74	0.47	(39)
Geol	5.04	0.67	(26)	LSComp	5.30	0.37	(54)	EECS	5.49	0.29	(74)				

*These responses are excluded from the Totals and F-prob. See Appendix A, p. A-11, for more information.

*A second administration in Winter 1978 of a survey in Biology, with the results obtained separately for each of the four plans, showed the mean ratings of the (1977) item on overall satisfaction with the major to be: Plan A1 (4.27), Plan A2 (4.03), Plan C (4.16), and Plan D (4.30), with the numbers of respondents, respectively, at 15, 39, 25 and 20.

STUDENT-RATED SATISFACTION WITH VARIOUS ACADEMIC MAJORS*

Department/Program	Mean Rating*	Percent Satisf.*	No. of Raters
SCHOOL OF BUSINESS ADMINISTRATION (Spr. 1979)			
Business Administration	5.30	78%	40
COLLEGE OF CHEMISTRY (Spring 1980)			
Chemical Engineering	4.61	60%	62
Chemistry	5.27	73%	37
COLLEGE OF ENGINEERING (Spring 1980)			
Civil Engineering	5.25	77%	75
Electrical Engineering & Computer Science	4.84	62%	74
Industrial Engineering & Operations Research	4.57	52%	21
Materials Science & Engineering (50% dbl maj)	5.04	68%	25
Mechanical Engineering	4.99	72%	87
Nuclear Engineering (double majors)	5.21	67%	24
COLLEGE OF LETTERS & SCIENCE			
Biological Sciences (Spring 1977)*			
Bacteriology	4.82	57%	28
Biochemistry	5.04	59%	28
Biology--Plans A1 & A2	4.27	47%	30
Biology--Plans C & D	4.06	50%	32
Biophysics, Medical Physics	4.96	71%	25
Botany	5.08	81%	26
Genetics	4.56	56%	25
Physiology	4.81	66%	27
Zoology	4.81	65%	31
Humanities (Spring 1977)*			
Art, Practice of	3.80	36%	25
History of Art	4.57	63%	61
French (Winter 1979)	5.00	67%	83
German	4.42	50%	12
History	5.47	82%	34
Music	4.38	62%	34
Spanish	3.52	35%	46
Physical Sciences (Spring 1980)			
Computer Science	4.89	66%	53
Geology	5.46	77%	26
Math	5.03	63%	38
Physics	5.40	88%	40
Social Sciences (Spring 1979)			
Anthropology	5.00	69%	36
Development Studies	6.13	96%	23
Economics	4.63	53%	40
Geography	6.29	95%	38
Linguistics	5.00	68%	41
Political Economy of Industrial Societies	5.27	77%	30
Political Science	4.35	51%	37
Psychology	4.15	51%	41
Social Science Field Major	5.93	85%	27
Social Welfare	4.28	44%	36
Sociology	4.62	63%	42
Women's Studies (Spring 1980)	5.95	80%	20
COLLEGE OF NATURAL RESOURCES			
Biology of Natural Resources (Spr. 1977)*	5.04	81%	26
Conservation of Nat. Resources (Spr. 1979)	5.88	91%	33
Food, Nutrition, Dietetics (Spr. 1977)*	5.25	79%	28
Political Econ. of Nat. Resources (Sp 1979)	5.38	73%	26

*The mean ratings reported above give more of a sense of the strength of student satisfaction while the percentages indicate the proportion of students who marked response 5,6 or 7 on the 1-7 scale (for example, there were more Geology than Physics students who responded "7" but there were also a few more Geology students who were dissatisfied, who responded "1", "2" or "3"). The 1977 item was worded differently than in 1979 and thereafter. The 1979 item: "All in all, how satisfied have you been to date with your major program (faculty, teaching, advising, courses/curriculum, testing-grading, governance, etc.)?" with responses 1= Very dissatisfied, 2= dissatisfied, 3= somewhat dissatisfied, 4= neutral or mixed feelings, 5= somewhat satisfied, 6= satisfied, 7= very satisfied. The 1977 item: "Please rate your overall level of satisfaction with your major program (faculty, teaching, advising, courses/curriculum, governance, etc.)" with responses 1= Extremely low, 2= Low, 3= Moderately low, 4= In between, 5= Moderately high, 6= High, 7= Extremely high.

APPENDIX A
Part I
CHARACTERISTICS OF THE STUDENT POPULATION

Introduction

This section of the report presents data concerning the respondents--their department/program affiliation, sex, ethnic identification, year in school, quarters at UCB, number of upper division courses completed in the major, time of response (first or second mailing), type of residence, source institution and ultimate degree plans. Also included is information on the relative importance of several possible goals of a college/university education, reasons for the student's choice of career or major, and some additional information on careers and graduate school-related intentions.

Where possible, the characteristics of the respondents are also compared with those of the sample as a whole. These comparisons are particularly important in any attempt to ascertain whether the respondents are in fact generally representative of the population for whom they have been asked to speak.

Part II of Appendix A provides information on the sample, survey and analyses, and also includes a study of the test-retest reliability of the students' responses. The special retest conducted by the ARU provides a unique opportunity to examine the extent to which programs may rely on the evaluative data obtained in the Undergraduate Major Program Evaluation Questionnaire from Berkeley students.

RESPONSE RATES

Overall, 620 of the total sample of 1143 students responded, a gross response rate of 54.2%. Excluding the 72 students who had moved without leaving a forwarding address, the (net) response rate was 57.9%. By program, the net response rates varied from 48% (in Chemical Engineering) to 76% (in Nuclear Engineering). Since one might expect higher proportions than average of juniors who were relatively new to their major, and of seniors who were just completing or had already become alumni, not to respond, this response rate is pretty reasonable (60% being about the most one could hope for without more intensive pursuit of nonrespondents). Broken down by program, the gross and net response rates are shown in Table 1 on the following page.

ANALYSES OF THE REPRESENTATIVENESS OF THE RESPONDENTS

Apart from the fact that the response rate is generally adequate, several additional checks on the representativeness of the respondents were conducted. Among these checks were an examination of the sex, ethnic identification and year in school of the respondents, as compared with the sample as a whole. The results of these analyses are shown in Table 2 (sex), Table 3 (class standing) and Table 4 (ethnic identification).

In addition, the respondents were divided into "early" and "late" groups, corresponding to whether they replied before, or after, the second mailing of the questionnaire (with about 10 borderline cases being included in the first group). Overall, net, 39.4% of the sample responded to the first mailing ("early"), 18.5% responded only after the second mailing ("late"), and 42.1% did not respond. Of possible special importance here is the question of whether "early" and "late" respondents differ in their evaluations of their educational programs. Since it was harder to get them to respond, the "late" respondents MAY be somewhat more representative of the nonrespondents. Consequently, the responses to every item in the questionnaire were examined to see whether the responses of the "early" respondents differed from those of the "lates." The results of this analysis are shown in Table 5, and the implications of the analysis are discussed in the footnote thereto (and summarized below).

Zero-Order Net Biases Among Examinable Respondent Characteristics

The available evidence tends to indicate that the respondents, with an occasional possible exception almost undoubtedly of minor importance, are rather representative of the sample population as a whole. The proportions of respondents who are men and women, of junior and senior status, and who chose various ethnic identifications, were much as expected. There were few or no significant differences between the views of the "early" (first-mailing) and "late" (second-mailing) respondents. And, as shown in Part II of Appendix A (see "Test-Retest Reliability of Student Evaluations of Academic Programs"), the reliabilities of the items, and of the students' responses were adequate and, on almost all if not all items, the average view of the students changed very little or not at all over a three-month interval between the initial "test" and the special "retest."

Examined by program, the results were much the same. In no program were the proportions of women, juniors, or any ethnic group as much as 10 percentage points different from the program's totals. Compared to expectations based on the department samples, women were very slightly overrepresented in Chemistry, Chemical Engineering and Civil Engineering, and underrepresented very slightly in EECS. Juniors were also overrepresented very slightly in Chemistry and Chemical Engineering. White/Caucasian students were very slightly overrepresented in Chemical Engineering and Civil Engineering, and Chinese/Chinese-Americans were very slightly underrepresented in the former. In any case, an educated guess (e.g., based on sample-wide item intercorrelations and research on previous ARU samples) is that none of these very slight deviations from expectation would cause a significant change in any of the results of the program evaluation of these departments.

DEMOGRAPHIC DATA

Overall, women comprise 20.9% of the respondents, men 79.1%. The proportions of women by program varied significantly [Chi-Square prob.= .0000], with the highest percentages in Geology (42%), Chemistry (41%) and L&S Computer Science (39%), and the lowest in Physics (5%), Nuclear Engineering (8%), EECS (8%), Mechanical Engineering (9%) and Materials Science (12%). [These data exclude respondents who changed majors, were too late for inclusion in the sample, etc., and thus differ slightly from the data shown in Table 2.]

The data on ethnic identification, based on the respondents' reports to the Office of Admissions and Records, but excluding the 47 double majors, are shown in Table 4. Apart from Nuclear Engineering and Materials Science (the programs with the double majors), the figures in Table 4 differ only slightly from those reported by the

Table 1
SAMPLE SIZES, RESPONSE RATES AND USABLE RETURNS, BY DEPARTMENT/PROGRAM

Department or Program[1]	Oriz. Sample Size	(minus) MLNAs[2]	Net Sample Size[2]	No. of Respond-ents	Actual Numbers in UMPEO Samples	Actual Numbers in ESQ Samples	Actual Numbers in Dept. Samples	Gross Resp. Rate	Net Resp. Rate[2]
Chemistry	100	- 9	91	49	37	--	--	49.0%	53.8%
Chemical Engineering	150	-11	139	67	62	58	59	44.7%	48.2%
Materials Science[3]	54	- 4	50	30	25	24	24	55.6%	60.0%
Nuclear Engineering[3]	43	- 2	41	31	24	24	--	72.1%	75.6%
Civil Engineering	150	- 8	142	79	77	77	77	52.7%	55.6%
Mechanical Engineering	150	- 6	144	92	87	85	85	61.3%	63.9%
Elec. Engg & Computer Scis.	150	-12	138	80	74	74	--	53.3%	58.0%
Indus. Engg & Operations Resrch	48	- 2	46	24	21	21	--	50.0%	52.2%
L & S Computer Science	100	- 3	97	54	54	--	--	54.0%	55.7%
Mathematics	74	- 6	68	41	38	--	--	55.4%	60.3%
Physics	75	- 2	73	46	40	--	--	61.3%	63.0%
Geology	49	- 7	42	27	26	--	--	55.1%	64.3%
Transfers w/in Engg[6]	--	--	--	--	22	22	--	--	--
Oth. Phys. Sci./Engg Transfers[6]	--	--	--	--	24	--	--	--	--
Unusable, late, blank[3]	--	--	--	--	6	7	3	--	--
Not Applicable[4]	--	--	--	--	3	5	5	--	--
TOTALS	1143	-72	1071	620	620	375	253	54.2%	57.9%

[1]See also page A-12 regarding the Social Science-related, Health-related Science, and Selected Humanities Samples.
[2]In calculating the net sample sizes and net response rates, persons who moved and left no address ("MLNAs") are excluded (subtracted from the original sample size)--but only if they were MLNAs as of the first mailing.
[3]For the UMPEO, this category includes 2 very late responses, 2 freshperson-sophomores, and 2 students who completed only the first page. For the ESQ, 1 Chem E. student left the questionnaire blank. Three of these respondents were in departments in which a departmental supplement was employed.
[4]For the UMPEO, ESQ, and departmental supplements, 3 students transferred to programs entirely outside the engineering and physical sciences. In addition, for the latter two questionnaires, 2 students changed programs within engineering (and were accidentally omitted from the "XferE" or Transfers w/in Engg group in the ESQ analysis).
[5]Excluding the MLNAs, 33 (66%) of the Mat. Sci. sample were double majors, as were 39 (95%) of the Nuclear Engineering group. Among the respondents, the percentages of double majors were 60% and 94%, respectively.
[6]See page xxv and page A-12 (footnote **) regarding the groups of major-transferrers.

Table 2
PERCENTAGE OF WOMEN STUDENTS:
AMONG RESPONDENTS AND IN SAMPLE AS DRAWN

Dept. or Prog. Abbv.	Pct of Women Students: Net* Among Respondents	Pct of Women Students: In Sample As Drawn*	Actual No. of Women Resps.	Expctd No. of Women Resps.*
Chemistry	34.7%	26.4%	17	12.9
Chem. Engg	28.4	22.3	19	14.9
Mat. Sci.	13.3**	17.0**	4**	4.6**
Nucl. Engg	3.8**	3.0**	1**	0.7**
Civil Engg	21.3	16.9	17	13.4
Mech. Engg	7.6	9.7	7	8.9
EECS	8.3	12.3	7	9.8
IEOR	25.0	21.7	6	5.2
L&S Comp. Sci.	40.7	36.1	22	19.5
Math	31.7	29.4	13	12.1
Physics	6.5	5.5	3	2.5
Geology	40.7	40.5	11	10.9
TOTALS	20.9%	18.6%	127	115.4

Table 3
PERCENTAGE OF JUNIOR STUDENTS:
AMONG RESPONDENTS AND IN SAMPLE AS DRAWN

Pct Juniors per OAR List: Net* Among Respondents	Pct Juniors per OAR List: In Sample As Drawn*	Actual No. of Junior Resps.	Expctd No. of Junior Resps.*
59.2%	51.6%	29	25.3
49.3	43.2	33	28.9
41.7**	47.1**	5**	5.7**
50.0**	50.0**	1**	1.0**
45.6	43.0	36	33.9
46.7	47.9	43	44.1
56.3	53.6	45	42.9
50.0	50.0	12	12.0
29.6	25.3	16	13.9
34.1	38.2	14	15.7
32.6	35.6	15	16.4
33.3	28.9	8	7.4
44.9%	43.2%	257	247.2

*All calculations exclude students who moved and left no address (see Table 1). The "expected" number of women, or juniors, among the respondents is calculated by multiplying the number of either in each program sample (as drawn) by the percentage of respondents.
**Since the OAR list of double majors excluded information about sex and class standing, the information for Materials Science and Nuclear Engineering was incomplete. The percentage of women students in these two programs relies primarily on an estimate of the students' sexes, based on their names. Three students in Materials Science and 8 in Nuclear Engineering were omitted from the calculations (i.e., their sex was not readily ascertainable) of the "expected" number of women (see footnote *) and the figures for "In Sample As Drawn." All of these double majors were omitted from the calculations regarding junior or senior status (leaving Nuclear Engineering with a sample of 2).

the respondents on the usable Undergraduate Major Program Evaluation Questionnaires from the 12 programs.* Of the 565 students included in the 12-program analysis: 62.5% were White/Caucasian; 18.8% were Chinese/Chinese-American; 7.4% were "Other" (consisting of 6.5% Other Asian, Oceanic, Arab, or Iranian plus 0.7% Pilipino/Philippine-American plus 0.2% Native American--nonCaucasian); 5.3% declined to state or left the item blank; 4.2% were Japanese/Japanese-American; 1.2% were Chicano (0.5%) or Latino (0.7%); and 0.5% were Black/Afro-American [UMPEQ #7].

The respondents' residences while attending Berkeley are shown in the right-hand columns of Table 6. There were no significant differences between students' residential patterns when examined by program [Chi-Square prob.= .5139; UMPEQ #8]. The type of school or college attended by the respondents immediately prior to coming to UCB is shown in Table 7, and again there were no significant differences between the 12 groups of students [Chi-Square prob.= .1088; UMPEQ #4].

Demographic data concerning the extent of the respondents' experience at Berkeley, and about their educational and career goals, are discussed subsequently.

EXTENT OF EXPERIENCE IN THE PROGRAM AND AT BERKELEY

Reported Class Standing and Number of Quarters at Berkeley. As shown in Table 6, by their own reckoning at the time of their response (i.e., mostly Winter, some Spring), 59.8% of the respondents in the 12 groups of students were seniors and 40.2% were juniors [UMPEQ #2]. Differences between the patterns of response were of borderline significance statistically [Chi-Square prob.= .0434]. (See footnote "**" of Table 6 regarding the differences between the proportion of seniors shown there, which is presumably most up-to-date, and that shown in Table 3.) The number of quarters the respondents in the 12 programs had spent at Berkeley is also shown in Table 6 [UMPEQ #3]. Differences in the patterns of response were again of borderline statistical significance [Chi-Square prob.= .0144].**

Depth of Experience in Program Curriculum. Column one of Table 6 shows the average reported number of upper division courses completed in the program for the respondents with usable UMPEQs, including the two groups of transfer students [UMPEQ #12]. Considering the data only for the 12 programs, the respondents have completed an average of 7.9 upper division courses in the major. There were significant differences between the reports from some of the programs [F-prob.= .0004]. The average number of upper division courses completed for the major by the respondents in Chemistry (5.5) was (or tended to be) significantly lower than in Nuclear Engineering (10.0), Materials Science (9.2), Civil Engineering (9.1), IEOR (8.7), Mechanical Engineering (8.4), Physics (8.4) and L&S Computer Science (8.1); the average in Math (6.3) was (or tended to be) lower than in the three departments where the respondents had taken the greatest number of courses. The high proportion of double majors in Nuclear Engineering (94%) and Materials Science (60%) presumably contributed to the high number of courses completed in the respondents' majors.

IMPORTANCE TO STUDENTS OF SIX POTENTIAL PROGRAM CONTRIBUTIONS (GOALS)

One section of the UMPEQ [66A-F] divided the principal, possible goals of a college/university education into six components and asked the students to rate the importance of each goal and also their program's contribution toward meeting that goal. The students' ratings of "Importance to you" for each of these six goals provide some information about the respondents' interest patterns and suggest something of their relative preference for curricular or program emphases. See page A-6 for the table presenting the responses to all six goals for all of the programs.

As an example, students in IEOR gave rather high ratings to the importance of the goals of "preparation for a career" (mean rating of 4.33), as did students in most (but not all) of the programs, and to "training in critical thinking and analysis" (4.29), as did students in all of the programs. IEOR students also rated as high the importance of "a broad, general, humanistic or person-centered education" (4.10) and of "promoting social responsibility or developing skills useful in the community" (4.00), and these ratings were ranked as high as those given in any of the other Engineering and Physical Science programs. Differentiating themselves further yet, IEOR students were the only group to rank these two goals higher in importance than "gaining a thorough understanding of the subject matter" (3.86). As one comparison, students in Physics and in Chemistry also assigned high importance to "training in critical thinking and analysis" (4.45, 4.43) and rated "preparation for a career" (3.98, 4.16) almost as high as did IEOR students. But Physics and Chemistry students rated as most important the goal of "gaining a thorough understanding of the subject matter" (4.75, 4.57) and, in accord with their future educational expectations (see Table 7), gave the most emphasis of any of the groups to "preparation for graduate or professional school" (4.36, 4.31), where the importance to IEOR students was relatively low (3.52). Finally, compared to IEOR students, the importance that Physics and Chemistry students assigned to a broad, general education (3.79, 3.50) and to "promoting social responsibility or developing skills useful in the community" (3.24, 3.64) was somewhat lower in numerical terms and, among the six goals, these were clearly of lower relative priority to students in Physics and in Chemistry.

The students' ratings of their "Program's contribution" to the six goals, as well as the average differences between the ratings of "Importance to you" and "Program's contribution" are discussed in the section "Overview of Department/Program Contributions" (pages 79-88).

Based on the sum of the responses from all 12 programs, three of the six goals were rated as being of rather high importance to the respondents. These were: gaining a thorough understanding of the subject matter;

*The data for respondents in Materials Science and in Nuclear Engineering, including double majors, as reported on the UMPEQ, using the categories cited in the text, are, respectively: Cauc. (72.0%, 62.5%); Chin. (12.0%, 16.7%); Other (4.0%, 8.3%); decline/blank (4.0%, 8.3%); Japan. (0.0%, 4.2%); Chic.-Lat. (4.0%, 0.0%); and Black (4.0%, 0.0%).

**Although the Chi-Square probability figure is of borderline significance statistically, it is a measure of whether there are differences between programs in the distribution of the responses across each of the five categories; no test was made of the mean number of quarters by program. By inspection of the percentage responses, the means seem less likely to be significantly different, because higher-than-average percentages in any one response category tend to be offset by lower response percentages in an immediately adjacent category.

Table 4

PERCENTAGE OF STUDENTS BY ETHNIC IDENTIFICATION AND PROGRAM: AMONG RESPONDENTS AND IN SAMPLE AS DRAWN

Dept. or Prog. Abbv.	Black/Afro-Am		Chicano-Latno		Chinese/-Amer		Japanese/-Am.		White/Caucas.		Other**		Decline State	
	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*	Among Resps.	In Sample As Drawn*
Chemistry	0.0%	0.0%	2.0%	2.2%	14.3%	15.4%	6.1%	5.5%	61.2%	64.8%	16.3%	12.1%	0.0%	0.0%
Chem. Engg	0.0	0.7	3.0	3.6	19.4	26.6	4.5	3.6	55.2	45.3	14.9	18.0	3.0	2.2
Mat. Sci.***	8.3	5.9	0.0	5.9	0.0	0.0	0.0	0.0	91.7	88.2	0.0	0.0	0.0	0.0
Nucl. Engg***	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0
Civil Engg	1.3	2.1	3.8	4.2	25.3	25.4	5.1	3.5	62.0	54.2	2.5	7.7	0.0	2.8
Mech. Engg.	0.0	0.7	1.1	2.8	15.2	12.5	3.3	3.5	65.2	63.9	10.9	13.9	4.3	2.8
EECS	0.0	0.0	0.0	1.4	26.3	24.6	8.8	5.1	47.5	48.6	13.8	15.9	3.8	4.3
IEOR	0.0	2.2	4.2	2.2	20.8	21.7	4.2	2.2	58.3	58.7	12.5	8.7	0.0	4.3
L&S C.S.	1.9	2.1	3.7	3.1	29.6	28.9	0.0	3.1	51.9	51.5	7.4	7.2	5.6	4.1
Math	0.0	1.5	0.0	0.0	2.4	2.9	4.9	4.4	80.5	79.4	7.3	7.4	4.9	4.4
Physics	0.0	1.4	0.0	1.4	4.3	6.8	8.7	8.2	80.4	75.3	6.5	6.8	0.0	0.0
Geology	0.0	0.0	0.0	0.0	3.7	4.8	7.4	7.1	85.2	83.3	0.0	0.0	3.7	4.8
TOTALS	0.5	1.1	1.7	2.4	17.5	18.6	5.1	4.3	63.2	59.7	9.4	11.0	2.6	2.9
Expctd Resp N:****	6.3		13.8		106.7		24.7		341.8		63.1		16.6	
Actual Resp N:	3		10		100		29		362		54		15	

*All calculations are based on the information given to the Office of Admissions and Records (i.e., rather than drawing upon the self-reports among respondents, which would have been mostly, but not strictly comparable, due to changes in "decline to state" status or differences in reporting for students with two ethnic backgrounds to identify with).

**Includes Vietnamese, Koreans, Thais, Pilipinos, East Indians/Pakistanis, et al., and, apparently, a number of Caucasians.

***Excludes double majors (for whom the OAR list did not include such information). With this exclusion, the Materials Science sample includes 17 students and 12 respondents, while Nuclear Engineering includes only 2 (of both). See text too.

****For each ethnic category, the "expected response number" is based on the product of the general response rate of 57.36% (573/999, after excluding the MLNAs and double majors) times the number of students in that category in the sample as drawn.

Table 5

UMPEQ ITEMS ON WHICH THE VIEWS OF RESPONDENTS TO THE FIRST MAILING MAY DIFFER SLIGHTLY* FROM RESPONDENTS TO THE SECOND MAILING

Evaluative Items (N=66)	UMPEQ No.	First Mailing Mean	First Mailing No.	Second Mailing Mean	Second Mailing No.	F-prob.* of Diff.
Prog. contrib.: Promo. social rspnsblty/dvlpg commu. skills	66Z2	2.47	388	2.70	178	.0182
My skills in oral communic. adeq. by time I graduate	62	3.56	409	3.36	190	.0260
My skills in written communic. adeq. by time I graduate	61	3.66	412	3.48	190	.0429
Enuf fieldwork-grp-lab crses or credit for acad-experiential	48	3.03	300	2.81	142	.0593
Prog. methods-lab-tech. crses overemph. tradl or out-of-date	51	2.35	347	2.50	162	.0617
Needed further explain, but help or referral not easy to obtain	32	2.89	352	2.71	162	.0670
Never notified of genl. undergrad orgzn/profl. socy. meeting	54	2.57	411	2.79	187	.0714
The coursework in this program is interesting and challenging	44	3.84	416	3.96	187	.0721
My skills in quanttv. anal. adeq. by time I graduate	63	4.15	407	4.03	188	.0806
Fac. shud occasly use Primer tchg eval. form, for public access	58	4.14	378	3.99	168	.0856
Next entry in F-prob. order:						.1433
Other, Nondemographic Items (N=18)						
Good income, job security important in career/major choice	70D	3.37	416	3.65	186	.0066
Imptnc. to you: Prepn for graduate or professional school	66B1	3.67	405	3.90	185	.0228
Next entry in F-prob. order:						.1209

*Given the total number of F-tests (84), 4.2 F-probabilities below .05 and 8.4 below .10 would be expected by chance alone. Hence, we cannot readily conclude that there are many differences, nor, with the mean ratings varying so little in magnitude, can we readily conclude that the observed differences are especially important. Of 77 items similarly tested in the Social Sciences Sample, 8 had probabilities below .10 (the lowest being .0082) and, again, none of the differences in means were large. Of the 12 items above, 8 were used in both samples. Of these 8, one result was in the same direction in the Social Sciences Sample (UMPEQ #58) and one was in the opposite direction (UMPEQ #51); the other 6 items all had F-probabilities of difference between the first and second mailing that were above .10.

The reader may also contrast the relatively weak differentiation here found between respondents to the first and second mailings with that found in the program-by-program analyses in both samples (see the last column of Table D of the section, "Test-Retest Reliability of Student Evaluations of Academic Programs," which is on page A-23).

Table 6
EXTENT OF EXPERIENCE IN THE PROGRAM AND AT UC BERKELEY; AND RESIDENCE[1]

Dept. or Prog. Abbv.	Average No. of Upper Courses in Major*	Number of Quarters at UCB					Reported Year in School**		Residence While Attending UCB					
		1-3	4-6	7-9	10-12	13&up	Jr.	Sr.	Dorm or Other UC-owned	Frat-Soror	Co-op	Home with Par., Rltvs	Apt., Hse, Hotl, Own Home	Other
Chemistry	5.49	29.7%	16.2%	18.9%	27.0%	8.1%	54.1%	45.9%	10.8%	2.7%	10.8%	21.6%	51.4%	2.7%
Chem. Engg	7.85	14.8	21.3	29.5	21.3	13.1	44.3	55.7	11.7	5.0	8.0	20.0	72.0	0.0
Mat. Sci.	9.21	4.0	32.0	24.0	40.0	0.0	32.0	68.0	0.0	8.0	8.0	8.3	72.0	0.0
Nucl. Engg	10.05	4.2	20.8	29.2	37.5	8.3	41.7	58.3	16.7	16.7	8.3	8.3	41.7	8.3
Civil Engg	9.12	20.8	15.6	24.7	32.5	6.5	41.6	58.4	10.7	8.0	2.7	21.3	54.7	2.7
Mech. Engg	8.43	19.5	14.9	31.0	25.3	9.2	51.7	48.3	9.2	9.2	2.3	19.5	54.0	5.7
EECS	7.30	21.6	12.2	31.1	29.7	5.4	52.7	47.3	10.8	4.1	6.8	23.0	51.4	4.1
IEOR	8.67	14.3	14.3	14.3	38.1	19.0	38.1	61.9	9.5	14.3	4.8	9.5	61.9	0.0
L&S C.S.	8.11	0.0	37.7	18.9	32.1	11.3	16.7	83.3	15.1	5.7	9.4	18.9	50.9	0.0
Math	6.29	18.4	21.1	31.6	23.7	5.3	28.9	71.1	5.3	0.0	7.9	18.4	65.8	2.6
Physics	8.38	5.0	30.0	40.0	20.0	5.0	30.0	70.0	17.5	5.0	5.0	15.0	57.5	0.0
Geology	6.38	7.7	26.9	26.9	34.6	3.8	23.1	76.9	3.8	3.8	19.2	3.8	65.4	3.8
SUBTOTALS	7.95	15.1%	20.6%	27.5%	28.8%	8.0%	40.2%	59.8%	10.5	6.4	6.8	18.0	55.2	3.0
Xfer Engg***	5.68(N=22)													
Xfer LSC***	6.14(N=22)													

[1]For the 12 programs, with a maximum of 565 respondents taken together, the number of respondents to the four items was: 557 (NumCrses), 563 (QtrsAtUC), 564 (YrInSch) and 560 (Residence).

*The question (UMPEQ #12) asked for "number of upper division courses completed in your major program" and indicated that courses in other departments should be included "only if they are required for your program or specialization." The maximum coded value accepted was set at 15—i.e., code 15= 15 or more courses. (A few students reported instead the number of units they had completed, but most of those, especially at values of 15 or more, were caught and re-estimated in the coding, with the help of information such as year in school and number of quarters at UCB. Completion of courses at UCB was also specified in the question.)

**Although students' views of whether they are classified as a junior or senior sometimes differ from classification based on units completed (or, on occasion, from what the student has reported previously), the answers given here are presumably current at the time of their response. These figures also differ slightly from those reported in Table 3 because these exclude program transfers (N=46) and unusable data (N=9). In both tables, the lower proportion of juniors in the Letters & Science programs is presumably attributable primarily to the early assignment of students to departments in the Colleges of Engineering and Chemistry, in contrast to the junior-level "declaration of major" used in L & S.

***Not all data was analyzed for these two groups. The first consists of students who transferred programs (including if they added or dropped a second major) within the engineering programs (including Chemical Engineering). The second consists of students who transferred programs in the physical sciences within L & S, between the L & S physical sciences and Chemistry (not Chemical Engineering), and to either of these from any engineering program.

Table 7
SOURCE INSTITUTION AND HIGHEST LEVEL OF EDUCATION EXPECTED TO ATTAIN IN THE NEXT TEN YEARS

Dept. or Prog. Abbv.	School or College Immediately Prior to Berkeley						Highest Level of Education Expected				
	High School	Two-year College	Other U.C. Campus	Other Coll. or Univ.	Other	No.	Bach. Degree	Teaching Credent.	Master's Degree	Ph.D. or Higher* Prof Deg	No.
Chemistry	51.4%	21.6%	5.4%	18.9%	2.7%	37	10.8%	0.0%	18.9%	70.3%	37
Chem. Engg	54.1	24.6	6.6	14.8	0.0	61	21.7	0.0	61.7	16.7	60
Mat. Sci.	44.0	40.0	8.0	8.0	0.0	25	12.0	0.0	72.0	16.0	25
Nuclear Engg	66.7	29.2	0.0	4.2	0.0	24	8.3	0.0	62.5	29.2	24
Civil Engg	50.6	36.4	0.0	13.0	0.0	77	23.4	1.3	68.8	6.5	77
Mech. Engg	54.0	32.2	5.7	8.0	0.0	87	30.2	1.2	62.8	5.8	86
EECS	52.7	33.8	5.4	8.1	0.0	74	9.5	0.0	75.7	14.9	74
IEOR	61.9	23.8	4.8	9.5	0.0	21	9.5	0.0	81.0	9.5	21
L&S Computer Sci.	48.1	31.5	11.1	9.3	0.0	54	17.0	0.0	77.4	5.7	53
Math	41.7	33.3	19.4	5.6	0.0	36	13.5	13.5	24.3	48.6	37
Physics	50.0	37.5	5.0	7.5	0.0	40	5.0	2.5	22.5	70.0	40
Geology	42.3	19.2	19.2	19.2	0.0	26	15.4	0.0	69.2	15.4	26
TOTALS	51.4	31.1	6.8	10.5	0.2	562	17.0	1.4	59.6	22.0	560

*Includes, e.g., "D.E., M.D., J.D., Ed.D., D.S.W., etc."

preparation for a career; and obtaining training in critical thinking and analysis. The other three goals, though still rated as being of fairly high importance, were somewhat less important to the respondents. For the first three goals, ratings indicative of "Very High" or "High" importance prevailed by overwhelming majority (87% or more). Such high ratings prevailed by large majority (60-65%) for the goals of: promoting social responsibility or developing skills useful in the community; preparation for graduate school; and obtaining a broad, general, humanistic or person-centered education.

Differences in Importance of Goals by Program

Concerning the importance of the goal of "gaining a thorough understanding of the subject matter," an overwhelming majority of the respondents rated it highly, a majority very highly (V.Low 0-1/6/37-56% V.High).* There were a few statistically significant differences between some of the programs, though some of the differences were of borderline consequence, perhaps over-differentiating between "High" and "Very High." Respondents in most of the programs gave higher ratings of importance to gaining a thorough understanding of the subject matter than did the students in IEOR (0-14/10/52-24). The goal was of highest importance in Physics (0-0/0/25-75), which, in addition to being higher statistically than IEOR, could also be differentiated from Chemical Engineering (0-0/5/48-47), Civil Engineering (0-0/4/50-46), Mechanical Engineering (0-1/7/39-53) and, almost, from Math (0-3/8/34-55)[F-prob.=.0027].

Overall, the goal of "preparation for a career" was of overwhelmingly high importance (V.Low 1-3/9/32-55% V.High), with a majority of the respondents again choosing the "Very High" response. The importance of preparing for a career was lower in Math (5-22/27/35-11) than in any other program [F-prob.= .0000], with only a plurality assigning it high importance. Preparation for a career was of highest importance in Civil Engineering (0-0/1/26-72), L&S Computer Science (0-2/6/22-70), Nuclear Engineering (0-0/4/33-63), Mechanical Engineering (0-0/8/33-59), EECS (0-1/7/34-58) and Chemical Engineering (0-2/6/34-58). Second lowest was Physics (5-5/15/38-38) where, though a very large majority agreed that preparation for a career was of high importance, ratings tended to be signficantly below the six engineering-related programs (above). Four other programs tended to rate the importance of career preparation lower than in Civil Engineering (but, like Physics, were above Math). These four were: Chemistry (5-5/11/24-54), Materials Science (0-4/16/24-56), IEOR (0-0/14/38-48) and Geology (0-0/8/50-42).

Ranked third in importance, but little different in emphasis from learning the subject matter and preparing for a career, with an overwhelming majority rating it high, both overall and in every program, was the goal of obtaining training in critical thinking and analysis (V.Low 1-1/9/46-44% V.High) [F-prob.= .4978].

Among the three goals of somewhat less, though still fairly high, importance was "promoting social responsibility or developing skills useful in the community." A large majority agreed that this goal was of high importance (V.low 4-6/25/41-24% V.High), and programs where a very large majority agreed tended to be above Physics (16-16/19/24-24), where agreement was by plurality. The students placing the highest importance on social responsibility or developing skills useful in the community were found in Materials Science (0-4/21/46-29), IEOR (0-0/21/58-21), Chemical Engineering (0-6/23/40-31), Mechanical Engineering (1-6/20/45-28) and Civil Engineering (3-0/24/51-23) [F-prob.= .0107].

Also fairly important, with a large majority giving high ratings (V.Low 3-10/28/36-24% V.High), was the goal of obtaining "a broad, general, humanistic or person-centered education." Although there were no significant differences found among the set of 12 mean ratings [F-prob.= .2291], the confidence intervals for two small programs ranking highest and lowest, overlapped only barely. These were IEOR (0-5/10/57-29) and Nuclear Engineering (4-22/35/22-17).

Finally, preparation for graduate or professional school was of fairly high importance also to a large majority of the respondents (V.Low 5-10/22/36-28% V.High). Overwhelmingly high importance was assigned to this goal in Physics (0-0/10/44-46) and in Chemistry (3-3/14/20-60), and both of these ratings were significantly higher than where this goal was of high importance only to a plurality, such as in Chemical Engineering (10-21/20/31-18) and Mechanical Engineering (11-12/28/27-22) [F-prob.= .0000]. Though preparation for graduate or professional school was of high importance to a majority or large majority in several other programs, this was usually a significantly lower level of emphasis than desired by students in Physics, and nearly so, in several instances, than in Chemistry. Programs in this lower-middle range, with the highest tending to be above Chemical Engineering and Mechanical Engineering, included: Geology (8-12/27/31-23) and IEOR (0-24/19/38-19), and L&S Computer Science (4-10/21/44-21), EECS (3-6/26/44-21), Math (5-5/22/41-27), Materials Science (4-4/28/32-32) and Civil Engineering (1-8/22/40-29).

CAREER GOALS AND MOTIVATIONS

Graduate School. The importance to the respondents of preparing for graduate or professional school was discussed in the immediately preceding paragraph, the program contributions to this goal are shown on p. 83 of the text, and the highest level of education expected is shown in Table 7. In response to this latter question [UMPEQ #5], 17% of the respondents indicated they would be likely to stop after obtaining the bachelor's degree; 60% expected to get a master's degree, and 22% the doctorate. There were significant differences between responses in some of the programs, based primarily on the proportions of students expecting to pursue a doctorate as contrasted with a master's [Chi-Square prob.= .0000]. The proportions planning to obtain a doctoral degree were highest in Physics (70%) and in Chemistry (70%), approached half in Math (49%), and were 29% in Nuclear Engineering, but otherwise ranged from 6% to 17%. The master's degree was the typical target of students in the engineering programs, and in L&S Computer Science and Geology, with 62% to 81% expecting to get one in the next 10 years. This degree was the final target for 19% to 24% in Chemistry, Physics and Math. The proportions planning to stop with a bachelor's degree ranged from a low of 5% (Physics) to a high of 30% (Mechanical Engineering), but apart from these two, ranged only from 8% to 23%.

In the text (page 63) is a discussion of the sufficiency of information provided about graduate and professional schools to which the students might wish to apply, and about whether they know enough now to decide when and

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Very Low" (V.Low) and "Low" [slash], through "In Between" [slash], to "High" and "Very High" (V. High).

Item: To what extent are the following goals important to you, and to what extent has your major program met them? [UMPEQ Q66.]

66A. Importance to you: Preparation for a career.

TOTALS — Engineering and Physical Sciences

1% Very Low (=1) 55% Very High (=5)
3% Low (=2) 9% In Between (=3) 32% High (=4)

Mean: 4.38 ± 0.07 (563) F-probability = .0000

Prog.	Mean	95% Conf.	N							
Math	3.24	± 0.36	(37)	Chem	4.16	± 0.39	(37)	Geol	4.35	± 0.25 (26)
*SHum77	3.83	0.14	(276)	*HltS77	4.23	0.09	(427)	*XsfLSC	4.39	0.34 (23)
Physic	3.98	0.35	(40)	MSE+	4.32	0.37	(25)	ChemE	4.48	0.18 (62)
*SocS79	4.09	0.09	(483)	IEOR	4.33	0.33	(21)	EECS	4.49	0.16 (74)

MechE	4.51	± 0.14	(87)
NuclE+	4.58	0.25	(24)
LSComp	4.61	0.19	(54)
CivilE	4.71	0.11	(76)
*XsferE	4.73	0.31	(22)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

66B. Importance to you: Preparation for graduate or professional school.

TOTALS — Engineering and Physical Sciences

5% Very Low 28% Very High
10% Low 22% In Between 36% High

Mean: 3.72 ± 0.09 (545) F-probability = .0000

Prog.	Mean	95% Conf.	N							
ChemE	3.26	± 0.32	(61)	LSComp	3.69	± 0.29	(52)	Math	3.78	± 0.36 (37)
MechE	3.37	0.28	(82)	*SHum77	3.71	0.15	(266)	*XsfLSC	3.83	0.50 (23)
Geol	3.50	0.49	(26)	EECS	3.76	0.23	(70)	MSE+	3.84	0.44 (25)
IEOR	3.52	0.49	(21)	*SocS79	3.78	0.10	(481)	CivilE	3.86	0.23 (73)

NuclE+	4.00	± 0.39	(24)
*XsferE	4.14	0.39	(22)
*HltS77	4.16	0.10	(425)
Chem	4.31	0.35	(35)
Physic	4.36	0.22	(39)

66C. Importance to you: Providing a broad, general, humanistic or person-centered education.

TOTALS — Engineering and Physical Sciences

3% Very Low 24% Very High
10% Low 28% In Between 36% High

Mean: 3.69 ± 0.09 (549) F-probability = .2291

Prog.	Mean	95% Conf.	N							
NuclE+	3.26	± 0.49	(23)	*XsfLSC	3.57	± 0.47	(23)	Math	3.68	± 0.41 (34)
Chem	3.50	0.34	(36)	CivilE	3.59	0.21	(76)	MSE+	3.79	0.37 (24)
*XsferE	3.52	0.60	(21)	EECS	3.60	0.24	(72)	Physic	3.79	0.41 (39)
Geol	3.36	0.45	(25)	MechE	3.67	0.23	(85)	ChemE	3.82	0.26 (62)

LSComp	3.90	± 0.25	(52)
*HltS77	3.96	0.09	(412)
IEOR	4.10	0.35	(21)
*SocS79	4.30	0.08	(484)
*SHum77	4.36	0.10	(272)

66D. Importance to you: providing training in critical thinking and analysis.

TOTALS — Engineering and Physical Sciences

1% Very Low 44% Very High
1% Low 9% In Between 46% High

Mean: 4.33 ± 0.06 (556) F-probability = .4978

Prog.	Mean	95% Conf.	N							
CivilE	4.17	± 0.15	(75)	MechE	4.29	± 0.15	(85)	*SocS79	4.35	± 0.07 (488)
Geol	4.23	0.29	(26)	EECS	4.30	0.19	(73)	*SHum77	4.38	0.10 (279)
*HltS77	4.27	0.09	(421)	NuclE+	4.30	0.36	(23)	*XsfLSC	4.39	0.28 (23)
IEOR	4.29	0.29	(21)	LSComp	4.31	0.20	(52)	ChemE	4.40	0.16 (62)

Chem	4.43	± 0.22	(37)
Physic	4.45	0.24	(40)
*XsferE	4.45	0.38	(22)
MSE+	4.48	0.24	(25)
Math	4.49	0.24	(37)

66E. Importance to you: Promoting social responsibility or developing skills useful in the community.

TOTALS — Engineering and Physical Sciences

4% Very Low 24% Very High
6% Low 25% In Between 41% High

Mean: 3.76 ± 0.09 (535) F-probability = .0107

Prog.	Mean	95% Conf.	N							
*XsfLSC	3.14	± 0.68	(21)	Chem	3.64	± 0.38	(33)	LSComp	3.78	± 0.27 (51)
Physic	3.24	0.47	(37)	Math	3.69	0.39	(32)	*SHum77	3.81	0.15 (247)
NuclE+	3.43	0.48	(23)	Geol	3.70	0.42	(23)	CivilE	3.91	0.19 (75)
EECS	3.56	0.24	(73)	*XsferE	3.77	0.56	(22)	MechE	3.92	0.20 (83)

*HltS77	3.93	± 0.10	(401)
ChemE	3.95	0.23	(62)
IEOR	4.00	0.32	(19)
MSE+	4.00	0.35	(24)
*SocS79	4.13	0.09	(474)

66F. Importance to you: Gaining a thorough understanding of the subject matter.

TOTALS — Engineering and Physical Sciences

—% Very Low 56% Very High
1% Low 6% In Between 37% High

Mean: 4.47 ± 0.06 (564) F-probability = .0027

Prog.	Mean	95% Conf.	N							
IEOR	3.86	± 0.44	(21)	CivilE	4.42	± 0.13	(76)	LSComp	4.50	± 0.17 (54)
*SocS79	4.35	0.07	(490)	MechE	4.44	0.14	(87)	NuclE+	4.50	0.33 (24)
ChemE	4.42	0.15	(62)	*XsfLSC	4.48	0.32	(23)	Geol	4.54	0.26 (26)
Math	4.42	0.25	(38)	MSE+	4.48	0.29	(25)	EECS	4.55	0.14 (74)

Chem	4.57	± 0.27	(37)
*XsferE	4.68	0.25	(22)
Physic	4.75	0.14	(40)

whether to go to graduate school. A related item, asked only in the engineering departments, inquired whether the students intended to go to graduate/professional school immediately after their undergraduate work [ESQ #26], and a large majority seemed to indicate that they did not (S.D. 28-32/15/14-12% S.A.).* The responses by program ranged from very large majority disagreement, such as observed in IEOR (37-37/11/11-5), Chemical Engineering (35-35/16/6-8) and Materials Science (33-33/19/10-5), to majority agreement in Nuclear Engineering (19-19/10/19-33) [F-prob.= .0308].

Item: I plan to attend graduate school immediately after completing undergraduate work. [ES Q26].

TOTALS -- Engineering

28% Str. Disagree, 32% Disagree, 15% In Between, 12% Str. Agree, 14% Agree

Mean: 2.49 ± 0.15 (323) F-probability = .0308

Prog.	Mean	95% Conf.	N								
IEOR	2.11	± 0.58	(19)	MSE+	2.19	± 0.53	(21)	EECS	2.57	± 0.31	(70)
ChemE	2.16	0.34	(51)	MechE	2.53	0.31	(75)	CivilE	2.58	0.35	(66)
*XsferE	3.00		(19)	NuclE+	3.29	± 0.72	(21)				

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

Reasons for Choice of Career or Major

In one five-part question [UMPEQ #70A-E], the students in all 12 Engineering and Physical Science programs were asked to rate the importance of five possible reasons for their choice of career or major. Of the five, the reason of highest importance, with a very large majority stressing it, was the opportunity to be creative or use their special talents (Not Impt. 1-7/16/37-40% Extr. Impt.).* Though the proportions choosing the responses "Very" or "Extremely" important varied only from a large to an overwhelming majority, there were significant differences between the student ratings in some of the programs [F-prob.= .0002]. The opportunity to be creative or use one's special talents was valued most among students in Physics (3-0/5/26-67) and second-most in Math (3-3/8/29-58). The ratings by Physics students were higher than in five other programs, and Math tended to be higher than four. The five were Geology (4-17/17/33-29), Civil Engineering (0-12/24/37-28), IEOR (5-5/24/38-29), Chemical Engineering (0-13/16/47-24) and L&S Computer Science (0-9/22/35-33). The data tables for all five questions about reasons for choice of career or major are shown on the following page.

Of only slightly less importance in the respondents' choices of career or major was the liking for the technical side of their work, which was very or extremely important to a large majority (Not Impt. 2-11/26/36-26% Extr. Impt.). The technical side of the work was least important in Math (5-34/18/24-18), and this was significantly lower than found in about seven other programs [F-prob.= .0010]. This reason for choice of career or major was also of significantly less importance in IEOR (5-10/43/33-10),and in Physics (5-15/28/23-30) and Civil Engineering (0-5/42/41-12), than in Nuclear Engineering (0-4/21/21-54), where it was rated highest.

Of third-ranked importance overall (and of slightly less importance yet) in the students' choices of career or major were reasons associated with being assured that their income would be good enough or with job security. This reason was very or extremely important to a majority of the students (Not Impt. 6-17/25/32-21% Extr. Impt.). Assurance of a good income or job security was generally more important in the engineering departments and L&S Computer Science than in the L & S departments and Chemistry [F-prob.= .0000]. Students in all of the former group rated this reason as significantly more important than did respondents from Math (14-43/30/3-11), and Physics (13-26/41/13-8) and Geology (13-38/13/29-8) also tended to have significantly lower ratings. The importance of a good income or job security as a reason for choice of career or major was also significantly lower among Chemistry students (8-24/27/27-14) than it was in the two highest-rated programs, Chemical Engineering (2-11/13/42-32) and Nuclear Engineering (4-4/25/29-38). The other programs where income or job security were relatively important include L&S Computer Science (0-15/22/30-33), Materials Science (8-4/29/29-29), EECS (4-12/20/49-15), Civil Engineering (1-17/24/38-20), Mechanical Engineering (3-8/28/33-23) and IEOR (0-14/43/29-14).

Fourth in importance, and slightly less important still, as a reason for choice of career or major was whether the students liked the human side of the work (Not Impt. 7-21/31/26-15% Extr. Impt.). The human side of the work was significantly more important to students in IEOR (0-0/20/55-25) than in all but about two other programs, and this reason tended to be of least importance in Materials Science (13-25/42/13-8) [F-prob.= .0089].

Least important of the five reasons for choice of career or major, with the mean rating being another slight step lower than the fourth-ranked reason, was the desire to make a social contribution (e.g., as a change agent or by serving in underserved communities). For this goal, the "Not at All" and "Somewhat" important responses exceeded the "Very" and "Extremely" important responses (Not Impt. 13-28/26/19-15% Extr. Impt.). There were no significant differences between the student ratings in the 12 programs [F-prob.= .1671], but the desire to make a social contribution seemed least important as a reason for choice of career or major in Geology (29-21/33/13-4) and L&S Computer Science (8-40/35/13-4).

Career Goals of Engineering Students

Students in the engineering departments (only) were asked toward what career or profession they were currently leaning; they were asked to indicate both the nature of the work and the kind of organization (if any) for which they expected to work [ESQ #1]. We then sought to develop a coding scheme for reporting the information.

In terms of the types of organization or control, one-third of the respondents (33.3%) provided information only about the nature of their expected work, and another 14.9% left the entire item blank or responded that they had no career in mind. One quarter (25.3%) cited organizations which were (known to us to be) large private corporations. In addition, 8.5% expected to work in a small private company. Those expecting to be self-employed (including as consultants) totalled 5.5% and another 5.2% indicated they expected to be consultants with a consulting firm (or simply wrote "consulting"). Students expecting to work for government totalled 6.9% (with 3.0% at the

*The figures in parentheses represent the percentages of respondents choosing each of the five response categories, ranging from "Strongly Disagree" (S.D.) and "Disagree" [slash], through "In Between" [slash], to "Agree" and "Strongly Agree" (S.A.), or, alternatively, from "Not at All Important" and "Somewhat Important" [slash], through "Important" [slash], to "Very Important" and "Extremely Important."

Item: Please rate the importance to you of each of the following possible reasons for your choice of career (however tentative) or major. [UMPEQ Q70.]

70A. Like the technical side of the work. [1977 wording: ... technical or scientific side ....]

TOTALS -- Engineering and Physical Sciences

2% Not at All Impt.(=1)
11% Somewhat Impt.(=2) 26% Important (=3) 26% Extremely Impt.(=5)
36% Very Important(=4)

Mean: 3.73 ± 0.08 (561) F-probability = .0010

Prog.	Mean	95% Conf.	N								
Math	3.16	± 0.41	(38)	CivilE	3.59	± 0.18	(76)	EECS	3.82	± 0.25	(74)	*XsferE	4.00	± 0.49	(22)
IEOR	3.33	0.44	(21)	ChemE	3.66	0.26	(62)	LSComp	3.85	0.27	(53)	MSE+	4.04	0.39	(25)
*HltS77	3.53		(386)	Geol	3.80	0.38	(25)	*XsfLSC	3.91	0.37	(23)	NuclE+	4.25	0.40	(24)
Physic	3.58	0.39	(40)	MechE	3.81	0.20	(86)	Chem	4.00	0.33	(37)				

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

70B. Like the human side of the work.

TOTALS -- Engineering and Physical Sciences

7% Not at All Impt.
21% Somewhat Impt. 31% Important 15% Extremely Impt.
26% Very Important

Mean: 3.21 ± 0.10 (535) F-probability = .0089

Prog.	Mean	95% Conf.	N								
MSE+	2.79	± 0.47	(24)	ChemE	3.03	± 0.31	(61)	*XsferE	3.32	± 0.60	(22)	NuclE+	3.48	± 0.60	(23)
*XsfLSC	2.96	0.56	(23)	Physic	3.05	0.39	(37)	MechE	3.34	0.25	(80)	*HltS77	3.77		(378)
EECS	3.01	0.25	(70)	LSComp	3.06	0.30	(52)	CivilE	3.39	0.21	(76)	IEOR	4.05	0.32	(20)
Chem	3.03	0.44	(35)	Math	3.26	0.52	(35)	Geol	3.41	0.54	(22)				

70C. Want to make a social contribution (as a change agent, serving underserved communities, etc.).

TOTALS -- Engineering and Physical Sciences

13% Not at All Impt.
28% Somewhat Impt. 26% Important 15% Extremely Impt.
19% Very Important

Mean: 2.95 ± 0.11 (535) F-probability = .1671

Prog.	Mean	95% Conf.	N								
Geol	2.42	± 0.50	(24)	Math	2.86	± 0.48	(35)	CivilE	3.15	± 0.27	(74)	*XsfLSC	3.22	± 0.70	(23)
LSComp	2.65	0.29	(48)	MSE+	2.95	0.60	(22)	IEOR	3.15	0.57	(20)	*XsferE	3.32	0.66	(22)
EECS	2.82	0.29	(73)	NuclE+	2.96	0.62	(24)	ChemE	3.18	0.30	(60)	*HltS77	3.47		(377)
MechE	2.85	0.28	(81)	Physic	3.13	0.45	(38)	Chem	3.19	0.46	(36)				

70D. Assurance that my income will always be good enough; or job security (e.g., unemployment won't be a problem, can relocate easily, etc.).

TOTALS -- Engineering and Physical Sciences

6% Not at All Impt.
17% Somewhat Impt. 25% Important 21% Extremely Impt.
32% Very Important

Mean: 3.46 ± 0.10 (558) F-probability = .0000

Prog.	Mean	95% Conf.	N								
Math	2.54	± 0.37	(37)	Chem	3.14	± 0.39	(37)	EECS	3.58	± 0.24	(74)	NuclE+	3.92	± 0.46	(24)
Physic	2.77	0.35	(39)	IEOR	3.43	0.42	(21)	MSE+	3.67	0.51	(24)	ChemE	3.92	0.26	(62)
*XsfLSC	2.82	0.47	(22)	MechE	3.55	0.25	(86)	LSComp	3.81	0.29	(54)				
Geol	2.83	0.52	(24)	CivilE	3.58	0.24	(76)	*XsferE	3.91	0.49	(22)				

70E. Opportunity to be creative or use my special talents.

TOTALS -- Engineering and Physical Sciences

1% Not at All Impt.
7% Somewhat Impt. 16% Important 40% Extremely Impt.
37% Very Important

Mean: 4.08 ± 0.08 (559) F-probability = .0002

Prog.	Mean	95% Conf.	N								
Geol	3.67	± 0.51	(24)	LSComp	3.93	± 0.26	(54)	Chem	4.22	± 0.32	(37)	Math	4.37	± 0.31	(38)
CivilE	3.80	0.22	(76)	*XsfLSC	4.14	0.42	(22)	EECS	4.24	0.18	(74)	Physic	4.54	0.27	(39)
IEOR	3.81	0.49	(21)	MechE	4.15	0.19	(86)	MSE+	4.25	0.38	(24)				
ChemE	3.82	0.24	(62)	NuclE+	4.17	0.39	(24)	*XsferE	4.27	0.39	(22)				

state and local level). Differences between the responses by program were of marginal significance [Chi-Square prob.= .0139]. The "No career in mind" or blank responses were highest in Materials Science (25%) and otherwise ranged from 12-19%. The proportion answering only the type of work was high in Nuclear Engineering (46%) and EECS (41%), and low in IEOR (19%), and otherwise ranged from 27-36%. Persons expecting to work for a large, private corporation were most prevalent in Chemical Engineering (40%), least frequent in Civil Engineering (9%), and otherwise fell into a narrow range from 25-29%. Work for a consulting firm, as a consultant, and on a self-employed basis was most prevalent in Civil Engineering (26%), was expected to some extent in IEOR (14%), Materials Science (13%) and Mechanical Engineering (9%), but otherwise ranged from 0-4%. Leanings toward work for a small, private firm were highest in Civil Engineering (14%) and IEOR (14%) and otherwise ranged from 3-9%. Expectations for work in government, at all levels, ranged from 0-10%.

The coding for the nature of the work toward which the respondents were leaning was more difficult. A fully effective sorting of the responses into coding categories would have required careful work by a team with knowledge about each of the seven fields and, in some cases, more precise responses than were actually given. As one example, we ended up with a category labelled "close in work" in a field (on materials, chemicals, etc.), with 14.6% of the respondents, overall, assigned to it (including 33% in Chemical Engineering, 19% in Mechanical Engineering, 14% in Civil Engineering, 13% in Materials Science, and 3-5% otherwise). And another 6.3% of the respondents simply reiterated the name of their major. There were also, again, 14.9% who simply did not know toward what career they were leaning or left the item blank (see above for departmental breakdowns). And yet another 2.5% answered only the type of organization or control. With these caveats, 15.2% of the respondents were leaning toward work in management (including sales and engineering management), with the highest proportion by far in IEOR (57%) and ranging otherwise from 8-17%. Students leaning toward work on aircraft, aerospace, naval architecture and weapons totalled 4.1%, with the largest contingent in Mechanical Engineering (13%) and 0-4% otherwise. Work in construction, mining and petroleum extraction was favored by 7.4%, with the highest interest in Civil Engineering (25%) and Materials Science (21%), and 0-4% otherwise. Energy-related areas, including conservation, and transportation were to consume 12.7% of the work of the respondents, with about half in more traditional areas and half not. The highest proportional interest was found among Nuclear Engineering students (25%), followed by those in Mechanical Engineering (16%), Civil Engineering (14%) and Chemical Engineering (14%), with 4-7% in the other three departments. Interest in work in electronics was expressed by 3.3% overall, but by 14% of EECS students (and 0-4% otherwise). Leanings toward work on computer hardware and design, at 6.1% overall, were drawn almost entirely from EECS majors (with 28% so leaning), as were leanings toward work on computer software (2.5% overall, 12% within EECS). Interest in research and/or teaching was at 9.4% overall, with highs in Nuclear Engineering (21%), Materials Science (17%), Mechanical Engineering (13%) and EECS (11%), and 1-7% otherwise. Finally, interest in biomedical applications was expressed by 1.1% of the respondents.

Definiteness of Career. A very large majority of the (nonblank) responses (70%) were indicative that the students were "Fairly certain" or "Definite" about their choice of career [ESQ #2]. Probably some of this fairly high degree of certainty is attributable to the students' choice of field (major) rather than to student identification of specific careers within the field. Another 20% of the respondents indicated that their choice of career was "Tentative." Six percent (6%) chose "Very tentative" and only 3% marked "No career in mind/absolutely don't know." (However, 7% of the entire group also left the question blank.) There was no difference in certainty of career choice by program [F-prob.= .6237]. (Apropos of the means cited in the table below, please note that the scale in this instance runs from 0-4, such that a mean of 2.65 is the equivalent of 3.65 on the usual 1-5 scale.)

Item: How definite is your choice of career? [ES Q2].

TOTALS — Engineering

3% No career in mind: absol. don't know (=0)
6% Very tentative (=1)
20% Tentative (=2)
21% Definite (=4)
49% Fairly certain (=3)

Mean: 2.79 ± 0.10 (337) F-probability = .6237

Prog.	Mean	Conf.	N									
IEOR	2.65	± 0.44	(17)	MechE	2.67	± 0.24	(79)	ChemE	2.79	± 0.28	(52)	EECS	2.88	± 0.21	(72)
MSE+	2.67	0.39	(21)	*XferE	2.77		(22)	CivilE	2.84	0.21	(73)	NuclE+	3.04	0.40	(23)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

Knowledge of Specifics of Career. A plurality of the students agreed (S.D. 8-20/31/29-11% S.A.) that they had a fairly good knowledge of the specific kinds of tasks they will be doing when they begin full-time work as a professional [ESQ #3]. There were no differences in the students' reports of their knowledge of future career tasks when examined by program [F-prob.= .8742].

Item: I have a fairly good knowledge of the specific kinds of tasks I will be doing when I begin my full-time professional work. [ES Q3].

TOTALS — Engineering

8% Str. Disagree
20% Disagree
31% In Between
11% Str. Agree
29% Agree

Mean: 3.15 ± 0.12 (348) F-probability = .8742

Prog.	Mean	Conf.	N									
XferE	2.43		(21)	ChemE	3.09	± 0.30	(55)	NuclE+	3.13	± 0.42	(23)	CivilE	3.27	± 0.24	(71)
MechE	3.06	± 0.26	(81)	MSE+	3.13	0.61	(24)	EECS	3.14	0.28	(74)	IEOR	3.40	0.51	(20)

*These responses are excluded from Totals and F-prob. See Appendix A, p. A-11, for more information.

APPENDIX A
Part II
THE SAMPLES, SURVEY AND ANALYSES

READING THE DATA TABLES

Most of the data tables in the text are comprised of the following elements:

1) Upper Left: An exact citation of the questionnaire item, including changes (if any) from wordings used in previous administrations to the comparison samples, and a reference to the item number and questionnaire from which it came. The questionnaires include the Undergraduate Major Program Evaluation Questionnaire (UMPEQ), the Engineering Supplement (ESQ), and supplementary questionnaires for students in Chemical Engineering, Civil Engineering, Materials Science, and Mechanical Engineering. (None of the information from the one-department questionnaires is suitable for presentation in the typical format of the data tables, which are designed for comparative purposes.) All of the questionnaires are included in Appendix C.

2) Upper Right: The totals, in percentages and as a mean, for the applicable responses from students in the 12 Engineering and Physical Science programs (if a UMPEQ item), or for the 7 engineering programs, including Chemical Engineering (if an ESQ item), and an "F-probability" figure. "Applicable" responses exclude those marked "Don't Know or Not Applicable" and blanks. For the typical item, the mean is calculated as shown on page A-14, with 1= Strongly Disagree (or Very Low) and 5= Strongly Agree (or Very High). Exceptions are noted in the tables. The mean is given along with its 95% confidence interval and, in parentheses, the total number of applicable responses to the item. (Confidence intervals are explained on page A-14.) The maximum possible numbers of applicable responses for each questionnaire and program are shown on page A-2 and on page xxv. The "F-probability" represents the likelihood that the differences in the means of the 12 (or 7) individual programs occurred by chance alone (i.e., lower numerical values imply an increasing likelihood that two or more of the reported means reflect real differences in the students' ratings, perceptions, and in the programs themselves). Responses from the major-transferrers within the Engineering and Physical Science Sample ("XsferE" and "XsfLSC") and the three comparison samples ("SHum77," "HlcS77," and "SocS79") are not included in the calculations of the total percentages, means, or in the F-probability tests. (The major-transferrers are defined on page xxv, and the comparison samples are described on page A-12.)

3) Across the Bottom: The program-by-program means, the 95% confidence intervals for each mean and, in parentheses, the number of applicable responses. (See point 2 for crossreferences to further information.)

QUESTIONNAIRE DEVELOPMENT AND DISTRIBUTION

Why Engineering and the Physical Sciences?

In 1977, the ASUC Academic Review Unit (ARU) conducted student survey evaluations in the entire array of health-related science programs at U.C. Berkeley. ARU questionnaires that year also enabled students to evaluate eight, selected humanities departments. In 1978, the ARU focused most of its energies on lower division, where problems seemed to be most pressing, comparing survey responses by college. [The recent increases in the number of lower division students can only exacerbate matters unless accompanied by appropriate modifications in resource deployment and faculty/administrative attention.] In 1979, the ARU returned to its more typical focus on upper division programs, with a survey-based evaluation of 14 Social Science-related programs. In Fall 1979, with the survey targeted for Winter-Spring 1980, the ARU's energies, with the sponsorship and support of the Engineers Joint Council, were focused on the largest, remaining sector of undergraduate major programs that had not yet been evaluated by students--Engineering and the Physical Sciences.

Questionnaire Development

The first Undergraduate Major Program Evaluation Questionnaire (UMPEQ) was developed by a committee of students with ARU guidance in Fall 1976, and was refined further in Fall 1977 on the basis of the results from over 700 upper division majors in that first, large-scale, Winter-Spring 1977 survey of students in the health-related sciences and some humanities departments. The use of many items of similar content in the Lower Division Program Evaluation Questionnaire (1978) and the development of some new items for that evaluation, also contributed slightly to the 1979 version of the UMPEQ used in the social sciences. The 1980 version, in turn, was modified slightly in the work with the Engineers Joint Council (with the help also of about 25 comments from faculty members scattered across the 12 Engineering and Physical Science programs).

In the initial questionnaire development, several other questionnaires used in previous, related research on upper division education were reviewed for their possible contribution to a questionnaire for use at the department level. In addition, a set of program evaluation criteria was also examined closely to see that the UMPEQ's coverage was as complete as possible. The committee also had some pretests and comments from ASUC Academic Affairs Office staff to assist them in questionnaire development.

While improvements in the UMPEQ have been made over time, as it turned out, only a few of the items in any given version of the questionnaire have been ambiguous or subject to misinterpretation by the respondents. However, commonalities in upper division programs spanning a range from Chemical Engineering to Art History are to some extent limited, and so is the typical respondent's knowledge of the more intricate aspects of his/her program, so there are always a few items where not applicable and blank responses will be frequent in one or another disciplinary area. The ARU uses a special footnote to call the reader's attention to all items where the number of applicable responses falls to 75% or lower. While UMPEQ items with related content are generally grouped together in the same section of the survey instrument, care is also taken in the ordering within sections to minimize the likelihood that any one item/statement will "lead" the student to respond in a particular way to a succeeding item (especially the immediately succeeding item).

The Engineering and Departmental Questionnaires. With ARU guidance throughout the process, the engineering and departmental questionnaires were developed to provide information not available from the UMPEQ. Concerns, comments, opinions, statements and questions by engineering students about their programs were converted into draft

questionnaire items. Some students suggested items directly. Though often arising in a one-department context, items that were of use across all seven departments were transferred to the general Engineering Supplement (ESO). At least 10 Engineers Joint Council (EJC) members and affiliated students participated substantially in the work, and the EJC as a whole had the opportunity to review the drafts on several occasions. Departmental supplements were developed whenever there was at least one student from that program intensively involved in the effort. The entire engineering faculty was also given a chance to comment on the draft Engineering Supplement, and the appropriate departmental faculties were invited to comment on a draft of their department's supplement. About 20 engineering faculty made helpful comments and these were used by the EJC committee in making final decisions about the items ultimately included. (L & S faculty were invited to comment only on the UMPEO.)

Questionnaire Distribution Procedures

The UMPEQ and the appropriate supplements were sent by first-class mail, addressed to individual students. A prepaid, return envelope and cover letter were also enclosed. Each student (and questionnaire) was given an identification number. As the daily rate of returning questionnaires declined to a trickle after the first mailing (in Winter Quarter), a second mailing (in early Spring Quarter), with a second cover note, was sent to all students who had not by that time responded. (See Appendix C for the questionnaires and cover letters.)

THE SAMPLES

Sample Selection Procedures

To obtain about 40 respondents (or more) in most programs, a sample of at least 75 students in each was drawn from an unexpurgated list of majors obtained from the Office of Admissions and Records (OAR). When there were 75 or fewer students, the entire population of majors was included. Larger samples were drawn for the four largest departments in engineering, to a maximum of 150, in order to maintain the approximate representativeness of the totals obtained, permit in-depth crosstabulation, and ensure enough raters for the course evaluations in the departmental supplements. Samples of 100 were drawn in Chemistry and L&S Computer Science because they are closely allied to Chemical Engineering and EECS, such that the comparative nature of the evaluation would be strengthened. The general target of about 40 (or more) respondents was chosen to keep confidence intervals small in size. (See also "Implications of the Sampling" and "The Analysis of Program Differences: Methods" below.)

The sample was drawn, taking every nth (or all) name(s), beginning with a randomly-selected name in the first nth, from the list of upper division majors enrolled in the 12 largest engineering and physical science programs at UCB. The OAR list of majors was ordered by department/program, within program by Zip Code, and alphabetically within Zip Code. The size of the nth varied from unity (1/1) to about one in three (1/3), depending on the enrollments and target sample sizes. For example, every major in Geology was included in the sample, while a little under one in three were chosen from EECS. (After initially selecting every nth student, a number of those drawn typically had to be eliminated by a similar procedure, involving selection of a new nth, or the use of a random number table, if very few had to be eliminated, to reduce the initial selections to the exact targeted size.)

After the questionnaires were returned, if a respondent indicated that he/she was enrolled in a different program than the one indicated by the OAR list, the student was excluded from the 12 (or 7) program analyses, even if the student had transferred to another program included in the sample.* The responses for two different groups of these major-transferrers, however, are usually reported (see page xxv for the definition of these two groups). Although excluded from the statistical tests and totals, the views of students in these groups may provide some indication of how students feel when they are least decided on direction, have somehow become disillusioned with their initial choice of program, or have otherwise fallen through some crack(s). One might hope that these students would be of concern at the College level if not also to the program from which they departed.**

Implications of the Sampling (the "Totals--Engineering and Physical Sciences")

THE TOTALS REPORTED FOR THE ENGINEERING AND PHYSICAL SCIENCE PROGRAMS IN THE DATA TABLES IN THE TEXT ARE BASED ON THE SUM OF ALL (applicable) RESPONSES WITHOUT REGARD TO PROGRAM. Because lower proportions of majors were sampled in the larger programs, these totals are not strictly representative of the "average" student nor the average program. One must weight (multiply) the program responses (means) shown in any given data table by the "Proportional Enrollments, Actual" for each (see the table, next page), and sum across the 12 products to obtain the mean response for the "average" student. If the reader is interested in focusing solely on the College of Engineering, similar calculations may be employed using the six "Proportional Enrollments, Actual, Engg Only" in this table. Here is one example of the results of the use of the weighting procedure: Using the ratings for "overall satisfaction" with the students' major program, the following results were obtained on the 1-7 scale: The mean rating for the 562 respondents as individuals was 5.02 (see page 89); considering all programs, weighted by size as shown in the table below, the mean rating was 4.99 for the "average" student; and the weighted mean rating for students in College of Engineering programs was 4.97. These point spreads would be much larger, e.g., on UMPEO 039 (page 2).

THE COMPARISON SAMPLES

For many survey items, this report includes the results for three, large, aggregated samples, each of which has been the subject of a separate Academic Review Unit report (see Appendix D). The three samples are the "Selected Humanities," the "Health-related Sciences," and the "Social Science-related Programs." Their abbreviations in the data tables are, respectively, "SHum77," "HltS77," and "SocS79." The numerical suffix on the abbreviation indicates the year in which the surveys were administered (all Winter-Spring). Whenever roughly the same

*Since the proportion of students sampled in each major program varied, the inclusion of students who were changing majors within the 12 programs might have distorted the randomness of the samples in the recipient programs. (For example, transfers from Chemistry to Chemical Engineering would have been overrepresented in the Chem. E. sample.)

**The "XsferE" group included: 4 transfers out of Materials Science and 6 out of Nuclear Engineering (including all double majors who retained only their other major), 2 transfers out of Civil Engineering, 3 out of Mechanical Engineering, 4 out of EECS, and 3 out of IEOR. The "XsfLSC" group included: 10 transfers out of Chemistry (many to Chemical Engineering), 4 out of Chemical Engineering, 1 out of Nuclear Engineering, 3 out of Math, 5 out of Physics, and 1 out of Geology.

Table 8
ACTUAL PROPORTIONAL ENROLLMENTS BY DEPARTMENT/PROGRAM

Department/Program	Dept./ Prog. Abbv.	Number of Upper Division Majors (per OAR list)*	Proportional Enrollments, Actual (Weighting Factor)**	Proportional Enrollments, Actual, Engg Only (Weighting Factor)**
Chemistry	Chem	207	.0945	----
Chemical Engineering	ChemE	302	.1379	----
Materials Science and Engineering**	**MSE+	54**	.0247	.0439
Nuclear Engineering**	**NuclE+	43**	.0196	.0350
Civil Engineering	CivilE	265	.1210	.2154
Mechanical Engineering	MechE	278	.1269	.2260
Electric Engineering and Computer Sciences	EECS	539	.2461	.4382
Industrial Engineering and Operations Research	IEOR	51	.0233	.0415
Computer Science (College of Letters & Science)	LSComp	178	.0813	----
Mathematics**	**Math	74**	.0338	----
Physics	Physic	150	.0685	----
Geology**	**Geol	49**	.0224	----
TOTALS		2190**	1.0000	1.0000

*The OAR name list did not include all students who declared their major after the 8th week of the Fall Quarter (1979), but did exclude all Fall-Quarter graduating seniors, such that the actual number of physical science (especially) majors is understated in these statistics. The numbers cited INCLUDE a number of students who had no address listed (who were eliminated before drawing the sample) as well as the 72 students identified as having moved and left no address.

**These totals and proportions exclude consideration of a few small departments with upper division majors (Astronomy, Statistics), several small interdisciplinary or group major programs (e.g., Engineering Science), double majors within or between colleges EXCEPT those enrolled in Materials Science and Engineering or Nuclear Engineering, all separately titled but allied programs offered in departments otherwise included (e.g., Geophysics, Applied Math, Math for Teachers), and all individual majors.

See the text (page A-12) for further explanation of uses, interpretation. Students in the process of changing majors are also excluded from the weighting procedure suggested in the text.

item wording was used in these previous surveys, the comparative results are given in the data tables. If the item wording was changed between the times of the different surveys, but not substantially, the change in wording is always cited in the data table if the comparative results have been included.

The Selected Humanities Sample

Overall, the gross response rate for the Selected Humanities Sample was 53%, the net 59%. Details about the sample may be found in the ARU's report, but a listing here of the number of respondents in each of the various majors may aid the reader in understanding the ratings of this aggregated sample. Since this sample was selected primarily to provide comparative information for the ARU's in-depth evaluations of Art History and Spanish, the results are not necessarily representative of the humanities as a whole. The Selected Humanities respondents were comprised of student majors in: Art--26; History of Art--64; History--35; Music--38; French--26; German--13; Spanish--48; Miscellaneous--34. (The Miscellaneous group included: Comparative Literature--3; Dramatic Art--1; English--20; Humanities Field Major--2; Philosophy--3; Rhetoric--4; and Religious Studies--1.) Compared to UCB's humanities programs as a whole, History (which is often and budgetarily classified as a social science) and the larger programs in the Miscellaneous group, both of which received relatively higher ratings than the other humanities programs on most items, are severely underrepresented in this Selected Humanities Sample.

The Health-related Science Sample

Overall, the gross response rate for the Health-related Science Sample was also 53%, the net 59%. Details about the sample may be found in the ARU's report on the Life-related Sciences, but a listing here of the number of respondents in each of the various majors may aid the reader in understanding the ratings of this aggregated sample. The Health-related Science Sample included respondents from: Bacteriology--32; Biochemistry--30; Biology, Plans A1 + A2--32; Biology, Plans B + C + D--31; Biology of Natural Resources--26; Bio/Medical Physics--25; Botany--26; Chemistry (in College of)--28; Chemistry (in L & S)--10; Food, Nutrition & Dietetics--28; Genetics--27; Physiology--30; Psychology--24; Zoology--32; major transferrers within the above-listed programs--17; and Miscellaneous Physical Sciences--40. (The Miscellaneous Physical Science group included: Astronomy--2; Geology--4; Geophysics--2; Mathematics--12; Physical Sciences Field Major--1; Physics--15; and Statistics--4.)

The Social Science-related Programs Sample

Overall, the gross response rate for the Social Science-related Sample was 51%, the net 54%. Details about the sample may be found in the ARU's report on the Social Science-related programs, but a listing here of the number of respondents in each of the various majors may aid the reader in understanding the ratings of this aggregated sample. The Social Science Sample included respondents in: Anthropology--36; Business Administration--41; Conservation of Natural Resources--34; Development Studies--24; Economics--40; Geography--40; Linguistics--41; Political Economy of Industrial Societies--31; Political Economy of Natural Resources--26; Political Science--37; Psychology--41; Social Science Field Major--27; Social Welfare--36; and Sociology--42.

GENERAL STRATEGIES OF INTERPRETATION

Summary of Methods. A summary of the key methodological points necessary to a reading of the text is presented just prior to the section on "Evaluative Findings" (page xxiv). There is no repetition here of the discussion in that summary regarding the systematic use of qualifying adjectives in the text of the report.

"Absolute" and Relative (Comparative) Perspectives on the Data

In the interpretation of the survey data presented in this text, there are two principal kinds of analytic perspectives employed. The first, or "absolute" perspective, focuses on the percentage of students who chose one (or more) response categories as contrasted with the percentage who chose other response categories. Ultimately, interpretations of such results, from an "absolute" perspective, rely on the item content, including the connotative and denotative aspects of the qualifying adjectives, if any, and the strength of the students' responses, one way or the other. Even so, such interpretations are not generated in a vacuum and cannot escape all relative or comparative considerations. Thus "absolute" interpretations can be made with respect to a range of possible standards--for example, from the standards one might hope to find in an "ideal" university to what we might ideally but realistically expect in upper division education at UCB. As a specific example, the fact that 48% of the respondents disagreed (and 40% agreed) that they knew at least one faculty member who could write them a good letter of recommendation would be seen as a terrible outcome in a highly-selective, liberal arts college. But at Berkeley, this fact might be something we would judge as "weak" or possibly "poor," but probably not as "terrible."

The second, or "relative" perspective, is one that compares the evaluations by one group of students with those of another group, and bases interpretations of the results on the relative placement of the responses of both groups. The relative perspective can be particularly important in identifying the comparative strengths and weaknesses of the 12 programs. In areas where at least one program shows a strong performance, there is a good likelihood that improvement in the lower-performance programs is fairly readily possible, and the high-rated program(s) may be able to serve as a model for the others. In areas where all programs are rated as having about the same degree of apparent weakness (as judged by a more "absolute" perspective), change may be needed across the board, but change may also be more difficult to achieve or require approaches new to the faculty.

Program-by-Program Review of Results. Among the key steps in the analysis was an examination for differences in the students' responses on a program-by-program basis. This is the heart of the evaluation, employing the relative perspective (and often clarifying what standards one might set at the "absolute" level as well). Since the department/program has primary responsibility for what happens to upper division majors, the programs also represent foci for which general or specific suggestions for improvements may be most relevant. Differences between programs can be seen in the data tables (see below) and are cited in the text every time they occur (i.e., are statistically significant). Data from the comparison samples (see above) provides additional information.

THE ANALYSIS OF PROGRAM DIFFERENCES: METHODS

In these analyses, occasional use is made of the "Chi-Square" probability. The Chi-Square statistic tests the entire pattern of responses, considered across all the response categories for an item and all 12 (or 7) programs. The Chi-Square statistic is based on the extent to which the results actually obtained differ from results that would be expected by chance alone. The results "expected" by chance are that the views of the students in each program will be the same as for the sample as a whole.

However, since the pattern of responses across a five-point scale (e.g.) may vary by program in ways that probably have little meaning,* whenever possible primary reliance is placed on a test for differences in program means (F-test). For purposes of calculating the mean ratings, the following illustrates the typical transformation of the qualitative-interval (ordinal) data to numerical figures:

1= Strongly Disagree		5= Strongly Agree
2= Disagree	3= In Between	4= Agree

"Don't Know or Not Applicable" and blank responses are NOT included in the calculation of the means (or percentages). While the test of means employed is strictly applicable only to scales with true numerical values, I, like many other social science researchers, have found that the mean ratings of survey items provide useful and meaningful one-figure summaries that seldom distort the results and are usually amenable to F-testing. Indeed, although the F- and Chi-Square probabilities are usually rather close in magnitude, it is probably safest to put one's trust in cumulative, linear differences (see *).

Probability Figures and Confidence Intervals

In the text, the results of the statistical tests are expressed in "probabilities." Lower numerical values for these probability figures indicate that there is a greater likelihood that the differences in the program ratings are in some way meaningful (i.e., that they are less likely to have occurred purely by chance). (Example: .0108 is lower than .1489; hence, the former probability expresses a lower likelihood that the results occurred by chance and, correspondingly, a higher probability that there are real differences between the responses of at least two of the groups.) Such probability figures are usually regarded as being indicative of "significant" differences between groups when there is a 95% likelihood that the observed differences did not occur by chance (i.e., when the probability figure is lower than .0500).

For every evaluative item in the UMFEQ and ESO, a table has been presented to show the mean rating of each program. Within these tables, a "95% confidence interval" (column headed "95% Conf.") is reported for each mean. Roughly stated, a confidence interval of 0.31 (e.g.) indicates that there is a 95% probability that the "true" mean falls within "plus-or-minus" 0.31 points (on the item's scale) from the mean obtained in the current sampling (as reported in an adjacent column). So, if a mean of 3.75 has a confidence interval of 0.31, the "true" mean has a 95% probability of falling between 3.44 and 4.06 (and is also more likely to fall, in accord with a "normal" distribution, toward the center of the range, i.e., 3.75, rather than toward the periphery).

If the confidence interval range (e.g., 3.44 to 4.06) for the mean of any particular program does not overlap with the confidence interval range of the mean rating of one or more other programs (e.g., a program with a confidence interval range of 2.75 to 3.25 on the same item), the means are here said to be "statistically different." Where the confidence interval ranges do overlap, it may well not be very safe to attribute any meaning to the observed (apparent) differences (which are usually modest in any case).

*For example, if most of the variation in student responses when broken down by program is with respect to adjacent response categories (e.g., one program's respondents may make heavy use of the category "Strongly Agree" while another program's respondents may make heavy use of "Agree"), the "differences" may be rather tenuous. (The same may be true, for example, of the adjacent responses, "In Between" and either "Agree" or "Disagree.")

APPENDIX A
Part III
TEST-RETEST RELIABILITY OF STUDENT EVALUATIONS OF ACADEMIC PROGRAMS

TEST-RETEST RELIABILITY IN PERSPECTIVE

In academic program evaluation surveys of students it is essential first that many/most of the questionnaire items be able to differentiate significantly between programs (i.e., where "real" differences exist between two or more programs). By definition, if the items differentiate between programs in proportion or in magnitude greater than expected by chance alone, it is unlikely that the raters' responses are entirely haphazard or random. On the other hand, if there are no significant differences between program ratings--even if raters give responses reliably--we cannot know whether the lack of difference is a function of the item wordings or of similar levels of performance by the programs. Practically speaking then, it is necessary for many or most items to be able to differentiate between programs, preferably even between programs of a generally similar nature.

Faculty and students alike sometimes wonder about the consistency or statistical "reliability" of student evaluations of (various aspects of) their academic programs. Basically, this question boils down to whether the individual student would give the same ratings when asked to respond a second time to the same questionnaire. If rater reliability is low, it is typically believed that the responses may be too imprecise, or too haphazardly given, such that the results may not be trustworthy or useful.

Although persistent questions about the reliability over time of student responses to an academic program evaluation survey have encouraged the development of this study, perhaps one of the first in this area, I also have argued generally that the stability over time of the students' mean ratings of (various aspects of) their academic programs is a more fundamental consideration in decisions about whether to trust and utilize such evaluative data. The more fundamental nature of the stability of mean ratings may be illustrated by examining the implications of a situation in which the means fluctuated markedly over a year or two (i.e., absent significant modification of the program in the interim). Clearly, if the mean ratings fluctuated markedly, no matter how reliable were the individual students' responses, little or no use could be made of the information to identify where programs needed strengthening. The argument supporting the greater importance of stable means is also based on the likelihood that students' evaluative views (including their response sets) are to some extent in flux, but that the changes over time will tend to cancel each other out.[1]

Despite the considerations leading to the conclusion that test-retest reliability is not a very critical property necessary for the use of survey evaluation data in the assessment of (academic) programs, the Engineering and Physical Sciences survey provided an opportunity to conduct a statistical analysis of the test-retest reliability of student ratings across 58 different items evaluative of the programs and the students' learning experiences. Since the data collection for the test-retest reliability study also provided a new opportunity for the study of the stability of mean ratings across a group of the <u>same</u> respondents at two different times of questionnaire administration, the study in fact was especially valuable.

Empirically, in the five cases thus far available, when Undergraduate Major Program Evaluation Questionnaire (UMPEQ) ratings of the same program by students have been obtained one or two years apart, the mean ratings were very similar (perhaps 80-90% of the item means showing no statistically significant change).[2] Such a result would be expected if the ratings are stable <u>as a group</u> (i.e., whether or not they are also reliable on an individual-rater basis), and if substantial change in (UCB's) academic programs has not occurred.[3] Apropos of the likelihood generally of change in academic worlds, Clark Kerr (a former U.C. President) has observed that one of the surprising things about the tumultuous 1960s is how little change actually came to the University.[4] If change did not occur in some rapid or fundamental ways in the 1960s, it is probably less likely to be occurring at present. Moreover, it has been my impression that Berkeley's departments/programs tend not to be particularly responsive to educational problems and needs, especially in undergraduate education, whether those needs have been identified by ASUC Academic Review Unit (ARU) surveys or by other methods.

In addition, we have previously demonstrated that the stability of mean ratings in ARU program evaluations is not (solely) due to the possibility that the UMPEQ items receive (roughly) the same mean ratings from students in every program. First, most of the items usually do differentiate statistically between two or more programs (thereby reflecting their potential to vary as well as two different times of questionnaire administration). (If the items are not able to differentiate between programs, their means by program will be stable, but spuriously so.) The differentiation by UMPEQ items was very effective (powerful) among the sample of 14 Social Science-related programs (where overall satisfaction with the major programs varied considerably), but was less so among the Engineering and Physical Science programs.[5] Secondly, we have found that the set of mean item ratings,

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[1] If the reliability of the individual (student's) responses were of primary concern (e.g., if we were typically seeking to study the respondents by dividing them into groups or "types" based on their answers), a different questionnaire design (or a large number of additional items) would be appropriate. One would want a number of items directed at assessing each of several principal dimensions (e.g., contact with faculty), such that each student's status could be studied more reliably and effectively by examining "scores," based on his/her responses to a set of items for each dimension. If the focus is on the program, however, the current design, which seeks to assess a reasonably full set of relatively unique evaluative criteria, can be more comprehensive and economical (i.e., if the questionnaire items differentiate significantly between programs and the means are stable over time). If a survey's item means are not stable over time, the same considerations apply--that assessment derived from a single item may not be very trustworthy and/or that several items should be developed to assess each dimension.

[2] Between 0% and 15% of the students in these evaluations replicated over one and two year time periods may have been the same individuals.

[3] Stable mean ratings of (various aspects of) an academic program would also be less likely to occur if there were rapid changes in the "types" of students who enrolled in it (which is also presumably rare).

[4] Kerr, Clark, The Uses of the University (with a New Postscript). New York: Harper & Row, 1972.

[5] Of the 71 UMPEQ items reported under "Evaluative Findings" in the ARU report on the Social Sciences, 40 of the distributions of the mean ratings of the 14 programs had a probability of occurring by chance alone that was below .0000, and another 18 had probabilities in the range, $.05 > p > .0000$. For 72 UMPEQ items in the same section of the Engineering and Physical Sciences Report, the distribution of the 12 program means had probabilities of occurrence by chance alone as follows: 12 at $p < .0000$; 11 at $.001 > p > .0000$; 9 at $.01 > p > .001$; 11 at $.05 > p > .01$; 9 at $.20 > p > .05$; and 21 at $p > .20$.

assessing various aspects of an academic program, is a better predictor of (more highly correlated with) the mean ratings of that same set of items a year or two later than are sets of the mean ratings for other programs. That is, the relative ordering of the mean ratings for a particular program also tend to hold up over time, and they can be predicted more successfully by mean ratings from students in the same program at a later time than by mean ratings from students in other, similar programs obtained in the initial survey administration.

Another factor is important in this instance (and perhaps also in the evaluation of most programs whose services extend over a long period of time). With very few exceptions, we have seldom found meaningful levels of correlation in UMPEQ survey data between year-in-school (i.e., junior versus senior status) and ratings of the various aspects of the academic programs. Thus there seem to be few consistent directions of change in student perceptions about their program as they become more experienced in or with it.[1]

THE SAMPLING

Since the time frame for the study permitted only one mailing reasonably prior to the dates for students' final examinations in Spring 1980, a sample size of approximately 100 was judged sufficient to obtain an adequate number of respondents to conduct the analyses of test-retest reliability and of the stability of the mean ratings. One-sixth of the total number of respondents was approximately equal to 100, as was one-fourth of the respondents to the first mailing. In order to achieve a retest that was generally about three months apart from the initial "test" and because the respondents to the first mailing might be somewhat more receptive to the special request to respond again to the UMPEQ, every fourth name from the first-round respondents was drawn. Since UMPEQ data previously had revealed few or no differences between the views of respondents to the first (Time 1) and second (Time 2) mailings--and this was again true for the Engineering and Physical Sciences evaluation (see page A-)--there seemed to be little or no harm in choosing the retest sample (Time 3) solely from among the first-round (Time 1) respondents.

Starting from a randomly chosen respondent in the first four and drawing every fourth (first-round) respondent thereafter, proceeding through the list of students in each of the 12 programs, the initial sample size came out to be 106. Two of these respondents were eliminated subsequently--one because he indicated he was still a freshperson[2] and the other because he rated a different program on retest than in his first-round response. Ultimately, 56 of the 104 students responded in a timely fashion (and there were two lates), a gross response rate of 56% (and, with two students who moved and left no address, a net response rate of 57%).

TEST-RETEST RELIABILITY TESTING

OBJECTIVES OF THE TESTS

The objectives of the tests are threefold. The tests examine test-retest reliability, provide a check on the representativeness of the respondents, and help to establish where item unreliability may have lowered rater reliability. In addition, the percentages of students choosing like, similar and different responses to various items are examined to provide a more common-sense view of the findings, which leads into the testing for the stability of the mean ratings.

1) Test-Retest Reliability (Rater Reliability)

The test-retest, which is to establish an estimate of the statistical reliability over time of the questionnaire responses by individual students (raters), is typically assumed to be the most fundamental of these three tests. For each respondent with a test and a retest, the responses to a set of 58 items in the initial testing (Time 1) were correlated with responses to the same set of items in the retest (Time 3), using a Pearson product-moment correlation coefficient (Pearson R).[3] If a UMPEQ item was evaluative of the student's academic program and employed ordinal-interval scaling of 1-5 length, it was included in the analysis.[4]

The most basic portions of the instructions to the retest respondents are quoted below. (The full letter of request for a second response is given as Appendix F.)

> When you fill out the questionnaire, simply proceed through the evaluation just as you did the first time, and just as if you were responding for the first time. Please DO NOT change your ratings to fit what you think your response was the first time. (If there is some change in student views over a 3-month period, as we would all expect, your "natural" answers this time will provide us with a best estimate of the extent of this change.)

2) Representativeness

Secondly, there was a need to make some attempt to verify the representativeness of those who responded to the retest. Accordingly, their responses were compared to those of the students who were invited to participate in the retest but did not respond. An F-test was used to see if there were any statistically significant differences between the mean ratings given by the two groups, to each of the 58 items in the initial testing (Time 1). In addition, mean ratings of 30 other UMPEQ items were compared for each of the two groups.

3) Item Reliabilities

The third analysis seemed useful as an indicator of which items were subject to the most variation in student responses between the times of test and retest. The hopes were to discover if there were any characteristics common to the more (and less) reliable items and to provide more information about the questionnaire items currently

[1] The importance of the stability of means is not diminished in a program where evaluations would differ by length of participation but, upon attempt at replication, the proportion of raters at each level in the program should remain the same (or the analysis should be conducted separately by level of program participant).

[2] This student's data was not used in the program analyses (and he did not respond to the retest).

[3] Please note that the data here is prepared for analysis in a reversal of the usual pattern--as if the raters were items and the items were raters.

[4] Though items with longer scales might be more reliable generally, only items scaled 1-5 were used to avoid artificially inflating the rater reliability coefficients.

in use. For the 56 students who twice had answered (Time 1, Time 3), the two responses were correlated for each of the 58 items (as well as a few others), using a Pearson product-moment correlation coefficient (Pearson R). To understand better the meaning of the findings in this analysis, and of the rater reliability coefficients obtained through the first test noted above, the changes over time in students' responses to the UMPEQ items were also examined in percentage terms.

RESULTS

1) Test-Retest Reliability

Though I assert that the stability of mean ratings across a group of raters (or across one or two year time intervals and different raters) is a more fundamental consideration in the determination of the utility of student evaluations of academic programs, I had some hope that the average rater's test-retest reliability coefficient might also be high, such that most doubts could be put to rest.

In the subsequent examination of item reliabilities, a simple schema of percentage breakdowns is employed systematically to compare students' responses at Time 1 versus Time 3. This examination is particularly useful to illustrate the "real" meaning or implications for program evaluation of various levels of item (or rater) reliability, as measured by Pearson product-moment correlation coefficients (i.e., for items scaled 1-5 in the fashion of most UMPEQ items). The statistics following below employ this same percentage-based schema:

For the student with the median rater reliability coefficient (of .673), the responses, comparing Time 1 and Time 3 (for the 52 items he answered at the two administrations), can be broken down into percentage terms as follows:

51.9% of the time-- exactly the same response was given at both times.
9.6% of the time-- agreement or disagreement was maintained, but it became one-point stronger or weaker.
61.5% Subtotal--same pattern of views
32.7% of the time-- the response was "In Between" either at Time 1 or Time 3, and the other response was one-point removed from the middle of the scale (e.g., was typically "Disagree" or "Agree" but not "Strongly Disagree" or "Strongly Agree."
94.2% Subtotal--no or minor shift in views
5.8% of the time-- the ratings of an item differed over time by two to four points on the 1-5 scale.
100.0% Total

The results of the rater reliability analysis, in terms of the Pearson product-moment correlation coefficients, are summarized in Table 1, but these results should be considered in light of the statistics concerning the median rater (above) and the section on item reliabilities.

Supplementary Information on the Impact on Rater Reliability Coefficients of Drifts and Shifts in Student Views. By an ex post facto examination of the rater reliability coefficients (excluding the outlier[1]), some additional information was obtained regarding the notion that minor drifts or shifts in student views, though typically nondirectional in sum, may have an exaggerated effect on rater reliability coefficients. For the 20 students (37% of 54) who had assigned ratings that had means with low standard deviations (less than 1.00, at Time 1 and/or Time 3), the mean Pearson R was .6153. By way of contrast, the mean Pearson R for the remaining 34 respondents was .6919. Thus, for the 20 low-variance raters, the predictability of the second response (Time 3) from the first was 37.86% (= $.6153^2$), while for the remaining 34 students it was 47.87% (= $.6919^2$).

The comparatively lower mean Pearson R for the 20 low variance raters seems to support the view that minor fluctuations in some students' views are a factor in reducing the average reliability coefficient for the sample as a whole. Where a student's agreement or disagreement is generally ventured more tentatively, it seems likely to be subject to (minor) change and, with fewer consistently strong opinions, these changes in ratings would have a greater-than-average negative impact on the magnitude of the rater's reliability coefficient.[2]

Distributionally, none of the 14 highest-ranking test-retest correlation coefficients (i.e., the 14 with Pearson $R \geq .7569$), and 8 of the lowest 14 coefficients, were obtained from the 20 sets of responses in which the students' answers showed little variation ($\sigma < 1.00$) from item to item.[3] Although overall rater reliability may be reduced by students with low-variance responses, to the extent that such drifts and shifts in views cancel each other out (i.e., to the extent the mean ratings of various aspects of a program are stable over time), there would seem to be no negative implications to the value of the data for purposes of program evaluation.

[1] The 56 usable responses include one that arrived too late for inclusion in the rater reliability analysis as well as one outlier, at 3.27 standard deviations below the grand mean of the reliability coefficients. The other 54 correlation coefficients were within the range of plus 1.47 to minus 1.86 standard deviations. Excluding the outlier, the five descriptive statistics reported in Table 1 would be: Mean Pearson R= .666, Standard Deviation= .128 and Mean Pearson R^2= 44.03%; Median Pearson R= .677 and Median Pearson R^2= 45.85%.

[2] That is: ratings at either extreme from a mean rating of an item have a higher impact on the magnitude of the Pearson R. Hence, persons expressing moderate views throughout a questionnaire will not have many consistently high or low ratings (anchor points?), such that the Pearson R will easily be reduced by minor drifts or shifts in views across the middle of the scale.

The idea that the 20 low-variance raters as a group are more often likely to venture their opinions tentatively (but that there is likely to be little impact on the stability of the mean ratings) is supported to some extent by another view of the data. For the typical UMPEQ item, the mean rating of these 20 raters (with two ratings each, totalling 40 means based on 58 or fewer items) was 3.276 and the standard deviation of these means was 0.211. For the remaining 34 raters (i.e., with 68 means based on 58 or fewer items), the mean response was virtually identical (3.273), but there seemed to be a somewhat greater diversity in the strength of the typical opinion (standard deviation= 0.266).

[3] Looking further at the distribution, 12 of the 20 low-variance raters had reliability coefficients which fell in the range from .6271 to .7634 (whereas only 10 of the other 34 raters fell within this same range, while 14 were above it)--suggesting fairly stable views among this subgroup, but ones tending to be moderate in tone--such that drift of ratings may be a relatively more important factor than shift of views in reducing reliability coefficients, particularly in contrast to the remaining 8 low-variance raters, whose reliability coefficients all fell in the range from .3957 to .5668.

Table A
RELIABILITY COEFFICIENTS FOR 56 UPPER DIVISION STUDENT RATERS OF 58 SURVEY ITEMS EVALUATIVE OF THEIR ACADEMIC PROGRAM: TEST-RETEST AT A THREE-MONTH INTERVAL*

Value Ranges for Pearson Product-Moment Correlation Coefficients	Frequency of Pearson Coefficients No.	Pct.	Descriptive Statistics	
.000- .099	0	0.0%	Mean Pearson R	.655
.100- .199	1	1.8	Standard Deviation	.142
.200- .299	0	0.0	Mean Pearson R^2	42.89%
.300- .399	2	3.6		
.400- .499	6	10.9	Median Pearson R	.673
.500- .599	9	16.4	Median Pearson R^2	45.35%
.600- .699	15	27.3		
.700- .799	14	25.4		
.800- .899	8	14.5		
.900- .999	0	0.0		
TOTALS	55	99.9		

*All the items here employed a 1-5 response scale. For a closer examination of the probable meaning of these correlations, see Table 3.

Table B
RELIABILITY COEFFICIENTS FOR 65 SURVEY ITEMS EVALUATIVE OF AN UPPER DIVISION ACADEMIC PROGRAM: TEST-RETEST WITH 56 RATERS AT A THREE-MONTH INTERVAL*

Value Ranges for Pearson Product-Moment Correlation Coefficients	Frequency of Pearson Coefficients No.	Pct.	Descriptive Statistics	
.000- .099	0	0.0%	Mean Pearson R	.578
.100- .199	0	0.0	Standard Deviation	.134
.200- .299	3	4.6	Mean Pearson R^2	33.42%
.300- .399	4	6.2		
.400- .499	8	12.3	Median Pearson R	.583
.500- .599	21	32.3	Median Pearson R^2	33.97%
.600- .699	14	21.5		
.700- .799	13	20.0		
.800- .899	2	3.1		
.900- .999	0	0.0		
TOTALS	65	100.0		

*For a closer examination of the meaning of these correlations, see Table 3.

Table C

PERCENTAGES OF RESPONDENTS WHO CHOSE LIKE, SIMILAR AND DIFFERENT RESPONSE CATEGORIES FOR 15 UMPEQ ITEMS AT TIME 1 AND TIME 3, WITH COMPARATIVE PEARSON PRODUCT-MOMENT CORRELATION RELIABILITY COEFFICIENTS

Item Abbv.* & (UMPEQ No.)	Pearson R T1 vs. T3* Corr.	Rank	Number of Students with T1 and T3 Responses	Pct. with Exactly the Same Response (5 cells)**	Pct. with 1-Point Shift w/in Agree or Disagree Categories (4 cells)**	SUBTOTAL: Pct. with the Same Pattern of Views	Pct. with 1-Point Shift, to or from "In Btwn" (4 cells)**	SUBTOTAL: Percent with No or Minor Shift in Views	Pct. with Shifts of 2 or More Scale Points (12 cells)**	TOTAL: (25 cells)**
StdtInpt(30)	.256	65	46	52.2%	4.3%	56.5%	32.6%	89.1%	10.9%	100.0%
Compettn(31)	.373	60	49	36.7	18.4	55.1	36.7	91.8	8.2	100.0
UGonComm(55)	.419	55	51	43.1	25.5	68.6	21.6	90.2	9.8	100.0
ReqCrses(42)	.487	50	52	50.0	9.6	59.6	23.1	82.7	17.3	100.0
CrseWork(44)	.513	45	55	63.6	9.1	72.7	20.0	92.7	7.3	100.0
CHumanEd(66C2)	.536	40	54	38.9	18.5	57.4	35.2	92.6	7.4	100.0
Schedule(45)	.573	35	54	51.9	9.3	61.2	22.2	83.3	16.7	100.1
MoreWork(29)	.583	33	54	63.0	18.5	81.5	9.3	90.7	9.3	100.1
FacIntUG(23)	.585	30	53	45.3	11.3	56.6	30.2	86.8	13.2	100.0
QuanSkil(63)	.613	25	54	72.2	22.2	94.4	3.7	98.1	1.9	100.0
UGMtgNtc(54)	.659	20	54	55.6	29.6	85.2	5.6	90.7	9.3	100.1
WritSkil(61)	.696	15	55	60.0	10.9	70.9	18.2	89.1	10.9	100.0
WriteRec(24)	.712	10	53	54.7	17.0	71.7	15.1	86.8	13.2	100.0
PropEthn(65)	.745	5	40	57.5	20.0	77.5	17.5	95.0	5.0	100.0
PropWomn(64)	.828	2	46	60.9	17.4	78.3	17.4	95.7	4.3	100.0

*All items reported here employ a 1-5 scale, in all cases but one (66C2) ranging from Strongly Disagree and Disagree, thru In Between, to Agree and Strongly Agree. The item "CHumanEd" (66C2) is scaled: Very Low, Low, In Between, High, Very High. (The second-highest ranked item, "PropWomn," is substituted for the first ranked because the latter employed a 10-point scale.) The times of test and retest are roughly three months apart.

**If responses to items were entirely random, at both times of administration of the UMPEQ, one would expect 4% of the responses to fall into each of the cells, such that 20% would be the same, 16% would shift between Strongly Disagree and Disagree or Strongly Agree and Agree (or vice-versa), 16% would shift to or from "In Between" to or from the adjacent categories (i.e., "Disagree" or "Agree"), and 48% would shift 2 or more scale points.

2) Representativeness

In the tests for representativeness, the students included in the reliability study were divided into two groups, consisting of those who did (N= 56) and did not (N= 48) respond to the retest. The groups were compared on all 58 pairs of item means obtained from the initial test (Time 1). In all 58 comparisons, the 95% confidence intervals of the two groups overlapped. Thirty additional items from the UMPEQ were also used in the testing for representativeness, and again there were no statistically significant differences observed between the 30 pairs of mean ratings by the two groups.[1] We conclude that the respondents to the retest are likely to be substantially representative of the retest sample as a whole, particularly as regards their views of their academic programs.

3) Item Reliabilities

The results of the analysis of item reliabilities are summarized in Table 2 and in Table 3.

To examine the results shown in Table 2 in a way that is more intimately associated with the actual, ordinal-interval scaling of most UMPEQ items (i.e., typically a 1-5 scale from "Strongly Disagree" to "Strongly Agree"), a second set of measures has been devised, samples of which are shown in Table 3. These measures seem more meaningful with respect to the implications of these data for evaluative theory and for the program(s) being evaluated.

In Table 3, for 15 UMPEQ items with various levels of Pearson correlation coefficients, we examine the percentage of students who: 1) gave exactly the same response upon retesting; 2) agreed, or disagreed, both times, but changed in the strength of either view; 3) had views that drifted or shifted to or from "In Between," but by no more than one scale point (i.e., to or from, e.g., "Agree" or "Disagree," but not to or from "Strongly Agree" or "Strongly Disagree"); and 4) gave any of the remaining patterns of response, all of which appear to involve clear changes of opinion (i.e., shifts of two or more scale points when comparing the Time 1 and Time 3 responses).

In addition, two of the columns in Table 3 give subtotals. The first subtotal represents the percentage of students with the same pattern of views--those who gave exactly the same response or otherwise continued to agree or disagree, albeit less or more strongly so. The second subtotal represents the percentage of students whose views changed very little or not at all--to a maximum of one point on the 1-5 scale.

Examined for the 58 items which are evaluative of the academic programs and employ a 1-5, ordinal-interval scale, the means for the percentage responses (such as illustrated in Table 3) show that:

50.7% of the time-- exactly the same response was given to the average item.
15.2% of the time-- agreement or disagreement was maintained, but it became one-point stronger or weaker.
65.9% Subtotal--same pattern of views
23.4% of the time-- the response was "In Between" either at Time 1 or Time 3, and the other response was one-point removed from the middle of the scale.
89.4% Subtotal--no or minor shift in views
10.6% of the time-- the ratings of an item differed over time by two to four points on the 1-5 scale.
100.0% Total

To examine the implications for evaluative theory and program evaluation, it is also useful to consider the 29 items with the lowest Pearson correlation coefficients (i.e., with reliabilities ranging from .256 to .574). For these 29 items, the means for the percentage responses show that:

47.6% of the time-- exactly the same response was given to the average item among the 29 with the lowest "R"s.
13.2% of the time-- agreement or disagreement was maintained, but it became one-point stronger or weaker.
60.8% Subtotal--same pattern of views
25.9% of the time-- the response was "In Between" either at Time 1 or Time 3, and the other response was one-point removed from the middle of the scale.
86.7% Subtotal--no or minor shift in views
13.3% of the time-- the ratings of the average item among the 29 with the lowest Pearson "R"s differed over time by two to four points on the 1-5 scale.
100.0% Total

The discussion about the implications of these results is resumed in the following section.

STABILITY OF MEAN RATINGS

For (academic) program evaluation, I have argued that the most important feature of (student) survey items is their ability to differentiate between programs, preferably between programs of a generally similar nature.[2] (See the section on "Test-Retest Reliability in Perspective.") Given the ability of many/most of the items in a survey to differentiate between two or more programs, I have argued that the stability of a program's mean ratings, over time, is a more fundamental consideration than rater reliability. The reasons why the stability over time of a program's mean ratings is important to evaluative theory and to decisions about whether to use student survey data in academic program evaluation may be summarized as follows:

[1] The other 30 variables included items about the importance of six possible goals of a college/university education, six possible reasons for the student's choice of career or major, and about the strength of seven possible influences on students' overall growth and learning while at UCB. Also included were two items about the student's overall satisfaction--with the major program, and in total at UCB. There were three items included about the extent to which the students were known by faculty members and one about the number of discussions they had had with a professor during the last three months. An item was included about the number of courses they had completed in the major (where the mean rose, but not significantly) and, for Fall 1979, about the number of units they had carried and the number of hours they were employed. Finally, the comparison also included items about the student's overall GPA at UCB and, for Fall 1979, the number of hours per week of study outside of class and lab, and the number of hours of study per unit per week outside of class and lab.

[2] This is not to say that a few items, typically those seeking the most general or positive assessment for a whole dimension (as contrasted with items more finely focused on particular aspects of that dimension), where interdepartmental differences are not necessarily expected, should be excluded from academic program evaluation surveys. Items of this kind are included in the UMPEQ (e.g., "FacTeach" and "CrseWork" and their mean ratings in Table 4).

1) Without stable means, the ratings would be useless in identifying the strengths or weaknesses of a program being evaluated; and

2) Over time, student views may be expected to show some drift and shifts, particularly when ventured tentatively, but if these changes are nondirectional, they do not affect the stability of mean ratings or the net assessment of the program (though they do lower rater reliability).

In the preliminary examination of the percentages of respondents with like, similar and different views, as presented in the preceding section and in Table 3, data were used that will now be examined also with respect to the mean ratings. In the former instance, the drift or shifts in students' second responses to 15 UMPEQ items and the average percentage change for all 58 items (and the 29 with the lowest reliabilities) were examined with respect to the original response. The analysis in the preceding section does not, however, address whether the responses to any of the items sum to a significant direction of change when one compares the first (Time 1) and second (Time 3) answers given three months apart.

OBJECTIVES OF THE TESTS

The question of concern is whether the net implications of responses, in this case from the same group of students, to scaled, ordinal-interval items, which are evaluative of various aspects of an academic program, are (roughly) the same, or significantly different, in a second administration of a survey three months subsequent to the first. The tests employed are oneway analyses of variance, as tests of whether there are differences in the mean ratings of 65 UMPEQ items.

RESULTS

Among the 65 tests for whether there were differences in the mean ratings of UMPEQ items over the three-month interval, two (2) showed probabilities of occurrence by chance alone that fell in the range, $.05 \geq p \geq .01$; one (1) fell in the range, $.10 \geq p \geq .05$; five (5) fell in the range, $.20 \geq p \geq .10$; and the other 57 probabilities were all greater than .20. With 65 tests, one would expect by chance alone that 13 of them would have a probability figure at or below .20 (8 actually did), that 6.5 of them would be at or below .10 (3 actually were), and that 3.25 would be at or below .05 (2 actually were). Since the observed probabilities fell entirely within the range expected by chance alone, it is entirely possible that there are no real differences in the mean ratings given to the 65 items in the two administrations of the UMPEQ (i.e., that the differences observed occurred by chance alone).

Hence, it is concluded that these ratings are stable over time and that changes in students' responses, to the extent that they appear to have occurred, represent drift and shifts in student views that are nondirectional in sum.

For each of the 65 items, the two mean ratings and the F-probability of difference between them, together with other information, are shown in Table 4. From the analyses of the means and the lack of significant differences between them over time, and from the other information presented in Table 4, two other important implications should be noted:

1) On all 58 items with 1-5, ordinal-interval scaling, at least 70% of the students gave a second response that differed by no more than one point from their response three months earlier. Indeed, in 56 of the 58 cases, at least 80% of the respondents gave responses indicative of "no or minor shifts in views." For the average item, 89.4% of the respondents gave answers indicative of "no or minor shifts in views," and for the 29 items with the lowest Pearson correlation coefficients, 86.7% did so. By chance alone, only 52% of the students' views would be expected to change by no more than one point on the 1-5 scale.

On all 58 items with 1-5, ordinal-interval scaling, at least 28% of the students gave a second response that was exactly the same as their first response three months earlier. By chance alone, only 20% of the students' views would be expected to be exactly the same. For the average item, 50.7% of the respondents gave answers that were exactly the same upon readministration of the test, and for the 29 items with the lowest Pearson correlation coefficients, 47.6% did so.

2) The general consistency of student responses over time, as shown in the percentage analysis (see point 1, above), seemed adequate to allow effective differentiation between departments, despite the seemingly low Pearson item reliability coefficients for at least some of the UMPEQ items. Of the 32 items with a Pearson R below the median, four (4) differentiated between two or more of the Engineering and Physical Sciences programs with a probability below .0000, and another five (5) did so with probabilities in the range, $.001 \geq p \geq .0000$. Among the 32 items with a Pearson R above the median, the performance was just a little better--seven (7) differentiated at a probability below .0000, and five (5) differentiated with probabilities in the range, $.001 \geq p \geq .0000$. For the 59 items in common to the Social Science Sample, where program ratings usually varied more substantially (and where the item reliabilities may also differ), the 29 items with the lowest Pearson correlation coefficients differentiated between programs (at or below .001) in 20 cases, and the 29 items with the highest Pearson reliability coefficients also differentiated between programs in 20 cases.

SUMMARY OF STUDY, RESULTS AND CONCLUSIONS

For purposes of (academic) program evaluation, and as regards evaluative theory in its application to program evaluation surveys (of students) used in the comparison of similar programs, I have argued that: 1) it is essential that many/most items in a survey be able to differentiate significantly between programs and, 2) that the stability over time of the mean ratings of the items assessing various aspects of a program is a more fundamental consideration than rater or item reliability.

For 58 ordinal-interval items with 1-5 scaling drawn from an Undergraduate Major Program Evaluation Questionnaire, administered twice to 56 students at a three-month interval, we have examined: 1) rater and item test-retest reliabilities (Pearson product-moment correlation coefficients) and the implications of these coefficients in terms of the percentages of students who gave like, similar and different responses; 2) the stability over the three-months of the mean ratings of each of the items; and 3) the frequency with which the item means differentiated significantly between two or more programs in two samples of 500 students.

For the 58 items, the median rater reliability coefficient was .673; the median item reliability was .503. Upon readministration, the average item was given exactly the same response 30.7% of the time, and nearly the same response (changed by one-point) another 38.6% of the time. Since almost all of the 58 item means were stable over time, such changes as there were in the students' responses were not cumulative (or directional) and, therefore, the implications of the ratings for the programs evaluated would likely remain the same in almost all instances. The 29 items with the lowest reliability coefficients were almost as effective as the 29 items with the highest reliabilities in terms of the percentage of students who gave exactly (47.6%) or nearly (39.2%) the same response upon readministration. The 29 low-reliability items were almost as effective as the 29 high-reliability items in differentiating between similar programs. Items with reliabilities as low as .367, or even lower, were successful in differentiating between the mean ratings of two or more (of 12) Engineering and Physical Science programs at the University of California, Berkeley.

Table D

FOR 65 UMPEQ ITEMS: TEST-RETEST RELIABILITIES, PERCENTAGES OF RESPONDENTS WITH LIKE, SIMILAR AND DIFFERENT RESPONSES, AND STABILITY OF MEAN RATINGS OVER A THREE-MONTH INTERVAL; ALSO, THE EFFECTIVENESS OF DIFFERENTIATION BETWEEN PROGRAMS

Item Abbv.[1] & (UMPEQ No.)	Number of Students with T1 and T3 Responses	Pearson Corr., T1 vs. T3	Pct. with Exactly the Same Response[2]	Subtotal: Pct. with the Same Pattern of Views[3]	Subtotal: Percent with No or Minor Shift in Views[4]	Analysis of Means[5] Time 1(N)	Time 3(N)	F-prob.	F-prob. of Diffs. between Depts.
SctdInpt(30)	46	.256	32.2%	56.5%	89.1%	3.37(49)	3.52(50)	.2920	.3703***
CrseRela(43)	53	.292	41.5	54.7	81.1	2.20(55)	2.68(53)	.0103	.0062***
FldWork (48)	38	.298	31.6	47.4	76.3	3.07(43)	3.30(44)	.3297	.0244***
CrseAdvn(18)	55	.367	40.1	60.0	80.0	3.23(56)	3.42(55)	.3666	.0002***
Compettn(31)	49	.373	36.7	55.1	91.8	3.37(51)	3.56(54)	.3154	.4443***
TestAccu(27)	55	.379	40.1	60.0	90.9	3.49(55)	3.48(56)	.9559	.5779
TradVoth(31)	42	.379	32.4	66.7	85.7	2.30(47)	2.43(49)	.4530	.0180**
OrientOK(19)	46	.411	41.3	52.2	80.4	2.96(52)	3.06(48)	.6421	.1910***
NonDomin(52)	27	.415	33.3	44.4	70.4	2.44(34)	2.31(42)	.2192	.1016***
UConComm(35)	31	.419	43.1	68.6	90.2	3.85(53)	3.85(52)	.9862	.7106
TeacEval(37)	53	.425	56.6	83.0	90.6	4.26(53)	4.11(56)	.4025	.0003***
LDPrereq(39)	55	.441	43.6	56.4	80.0	2.90(55)	2.63(56)	.4434	.0000***
CCarGoal(66A2)	53	.464	45.3	67.9	98.1	3.69(54)	3.34(55)	.2990	.0000***
ValeLess(35A)	48	.466	77.1	77.1	95.8	3.13(52)	2.98(49)	.1537	.2008
RecCrses(42)	52	.487	50.0	59.6	82.7	2.85(55)	2.91(53)	.8076	.0000***
CCritic1(66D2)	55	.503	54.5	67.3	94.5	3.87(55)	3.93(56)	.7254	.0173**
FacContct(22)	55	.504	36.4	45.5	80.0	2.96(55)	3.20(56)	.3024	.0304***
[Instruct(67A)]	56	.511	[64.3]	--	[96.4]	[3.61(56)	3.61(56)]	1.0000	.0419
[FacDiscs(15)]	56	.511	[41.1]	--	[82.1]	[3.71(56)	3.88(56)]	.7265	.2957**
CrseWork(44)	55	.513	63.6	72.7	92.7	3.80(56)	3.32(55)	.9208	.0026***
FacSeats(28)	53	.513	41.5	54.7	83.0	2.83(54)	3.28(54)	.0231	.5165**
TeacBack(25)	53	.522	50.9	58.2	81.8	3.00(56)	3.22(55)	.2623	.0012***
TradInfo(17)	50	.532	42.0	54.0	88.0	2.80(51)	2.80(54)	.9718	.0577***
TrustFac(36)	53	.533	52.8	64.2	96.8	3.11(53)	3.32(56)	.2625	.3280***
CHumanEd(66C2)	54	.536	38.9	57.4	92.6	2.63(54)	2.64(56)	.9413	.4148***
Complain (32)	43	.547	27.9	44.2	93.0	2.76(45)	2.64(50)	.6027	.7327
CarInfo (16)	53	.553	39.6	54.7	88.7	2.98(53)	3.20(55)	.3101	.0000***
Caliber (60)	54	.556	70.4	85.2	94.4	3.34(55)	4.11(54)	.1103	.0003***
ProbSolv(50)	46	.562	50.0	63.0	84.8	2.76(49)	2.73(53)	.9085	.0002***
Schedule(45)	54	.573	51.9	61.2	83.3	2.64(56)	2.30(54)	.4776	.0049***
CrseObjs(40)	54	.574	57.4	72.2	87.0	3.59(54)	3.63(56)	.8754	.0051***
TAKnowl (37A)	54	.579	48.1	68.5	81.5	3.78(54)	3.98(54)	.3664	.0002
MoreWork(29)	54	.583	63.0	81.5	90.7	4.38(55)	4.49(55)	.5338	.0000**
CSocReso(66E2)	50	.585	42.0	58.0	90.0	2.55(51)	2.44(55)	.5878	.0001***
FacInCUG(23)	53	.585	45.3	56.6	86.8	2.69(55)	2.39(54)	.1171	.2263***
CSubKnow(66F2)	55	.597	52.7	72.7	98.2	3.80(56)	3.89(55)	.6017	.1527***
OpenComu(21)	52	.601	44.2	61.5	94.2	3.33(54)	3.44(54)	.3431	.0001***
AdvnCrse(41)	52	.603	51.9	65.4	88.5	3.57(53)	3.62(53)	.7889	.0008***
CGradSch(66B2)	50	.606	52.0	76.0	90.0	3.81(52)	3.74(53)	.7100	.0242
QuanSkil(61)	54	.613	72.2	94.4	98.1	4.22(54)	4.05(56)	.1973	.6261---
[SvName (14B)]	55	.618	[34.5]	--	[61.8]	[4.30(56)	4.38(55)]	.8960	.1879---
FacTeach(36)	56	.642	57.1	76.8	94.6	3.82(56)	3.98(56)	.3303	.0200***
Primer (58)	46	.649	30.0	78.3	95.7	4.06(52)	3.88(50)	.3903	.0247
SmClass (47)	42	.649	30.0	57.1	90.5	3.02(43)	3.24(50)	.3370	.0000***
UGMtgNtc(54)	54	.659	35.6	85.2	90.7	2.51(55)	2.35(55)	.5236	.0000***
[SvSight (14A)]	54	.663	[37.0]	--	[59.3]	[6.20(56)	5.87(54)]	.5748	.0121---
TATeach (37B)	52	.678	36.5	63.5	86.5	3.28(54)	3.17(53)	.6726	.0039
LrLecOK (46)	50	.684	52.0	62.0	92.0	2.30(52)	2.86(51)	.0849	.0004***
Equipmt (49)	48	.692	37.5	54.2	91.7	3.13(48)	3.19(53)	.8635	.0000
WritSkil(41)	35	.696	60.0	70.9	89.1	3.45(35)	3.57(56)	.6000	.0023---
EthncFac(35)	39	.707	66.7	71.8	82.1	2.86(43)	2.89(44)	.9267	.0237***
[ProgSat (69)]	56	.710	[50.0]	--	[83.9]	[5.25(56)	5.41(56)]	.3671	.1802***
SocIssue(33)	38	.711	44.7	55.3	97.4	3.05(41)	3.13(45)	.7015	.3881***
OralSkil(62)	54	.711	53.7	64.8	92.6	3.35(55)	3.36(55)	.9317	.0552---
WriteRec(24)	53	.712	54.7	71.7	86.8	3.11(55)	3.42(53)	.2973	.0002***
[TotalSat(68)]	56	.717	[60.7]	--	[83.9]	[5.68(56)	5.77(56)]	.7014	.2134
Remember(53)	54	.722	50.0	68.5	98.1	3.42(55)	3.70(54)	.1198	.0001***
MinorFor(39B)	46	.727	34.8	89.1	97.8	2.80(50)	2.86(50)	.3760	.3521
GradeRig(24)	52	.729	51.9	71.2	96.2	3.65(52)	3.82(56)	.4407	.0000**
PrepEthn(65)	40	.745	57.5	77.5	95.0	3.27(49)	3.24(42)	.9140	.3640***
WomenFac(34)	38	.750	57.9	76.3	89.5	2.47(43)	2.51(45)	.8739	.0809***
FacAdvsr(20)	56	.775	50.0	71.4	91.1	3.34(56)	3.41(56)	.8464	.0000***
OfcStaff(39)	49	.798	39.2	81.6	98.0	3.69(52)	3.83(53)	.6848	.0000***
PrepWomn(64)	46	.928	60.9	78.3	95.7	3.48(50)	3.65(48)	.3430	.0000***
[AsPerson(14C)]	52	.940	[50.0]	--	[76.9]	[1.98(55)	2.17(53)]	.6674	.2347---

[1] All items except those in brackets (see footnote 2) employed a 1-5, ordinal-interval scale with "In Between" as the mid-point. These scales run from "Strongly Disagree" and "Disagree" to "Agree" and "Strongly Agree" except for items 66A-F, which is scaled from "Very Low" and "Low" to "High" and "Very High."

[2] The items in brackets employed scales of length 1-4 (UMPEQ 67A), 1-5(15), 1-7(68-69) and 1-10(14A-C). These items are not strictly fitted to the criteria used in the percentage breakdowns (see footnote 1). The mean for FacDiscs is recoded to represent the actual number of discussions with faculty (i.e., does not use the original scale metric).

[3] A few items are designed to focus on only the most recent quarter [e.g., TeacEval(37), FacDiscs(15), UGMtgNtc(54)] and are subject to sudden changes in individual ratings, such that their reliability over a three month interval might be artificially reduced. Other items may also cover topics more likely subject to short-term change within the program or by students' experiences in their most recent quarter(s) [e.g., SctdInpt(30), CrseRela(43), CrseAdvn(18), TestAccu(27), etc.]. The "F-prob." represents the probability that the difference between means for Time 1 and Time 3 occurred by chance alone. Probabilities below .05 are normally regarded as unlikely to have occurred by chance alone (but see the accompanying text).

[4] *,**,***In the Social Science Sample with 14 programs and 496 UMPEQ respondents, these items differentiated between two or more departmental mean ratings with probabilities below .001 (***) or in the range, .01>p>.001 (**). A blank indicates that probabilities were above .01 whereas a "---" indicates that the item was not included in the UMPEQ at that time (Winter-Spring 1970).

APPENDIX B

RESULTS OF RESPONSES TO THE FOUR DEPARTMENTAL SUPPLEMENTS IN ENGINEERING--CIVIL, MATERIALS SCIENCE, MECHANICAL AND CHEMICAL*

CIVIL ENGINEERING SUPPLEMENT

	Str Disag	Disag	In Btwn	Agree	Str Agree	Mean	N.
1. At the end of my undergraduate study, the program will have met the goals specified in the College's Announcement, in that I will:							
A. be "well grounded in the sciences."	-----	-----	16%	60%	24%	4.09	70
B. be "educated in social and humanistic studies."	3%	43%	33	17	4	2.77	70
C. be "cognizant of economic factors."	4	19	41	34	2	3.09	68
D. have "competent knowledge of the principles that underlie the broad practice of the profession."	2	6	15	68	10	3.79	68
2. Civil Engineering 190 (technical writing course) should be made a required course for all Civil Engineering majors.	5	12	17	27	39	3.83	59
3. There should be a significant oral component of Civil Engineering 190 (current emphasis is primarily on technical writing).	9	7	18	47	19	3.61	57
4. The Department does not seem to recruit faculty with enough experience in the practice of professional engineering.	12	44	30	14	-----	2.46	57
5. The Department seems to put too much emphasis on research and not enough on the teaching ability of faculty.	2	17	31	37	14	3.45	55

*See Appendix C, page C-1, for more information on the layout of the original departmental supplements.
The results from the majors' ratings of their coursework (pages B-2, B-4, B-6 and B-10) are summarized in tables presented in the text of the report (pages 16, 47). (Also, the course numbers and titles for these questions--CEQ #1, MSEQ #1, MEQ #1 and ChEQ #23--were originally laid out horizontally with the fill-in ratings, though the course titles were given in abbreviated form when necessitated by space limitations.)

CIVIL ENGINEERING SUPPLEMENT
(continued)

Department, Course Number and Title

Mechanical Engineering 104A, Engineering Mechanics II
Civil Engineering 118, Engineering Geology
Civil Engineering 130A, Mechanics of Materials
Civil Engineering 165A, Elementary Fluid Mechanics
Civil Engineering 110, Properties of Structural Materials
Civil Engineering 121, Soil and Foundation Engineering
Civil Engineering 131, Introduction to Structural Analysis
Civil Engineering 165B, Elements of Fluid Mechanics for Civil Engineers
Civil Engineering 133, Theory of Reinforced Concrete Design
Civil Engineering 134, Elements of Metal Structures
Civil Engineering 140, Water Resources Engineering
Civil Engineering 170, Introduction to Transportation Engineering
Civil Engineering 141, Water Quality Management
Civil Engineering 192, The Art and Science of Civil Engineering Practice
Civil Engineering 194, Economics and Management of Engineering Systems

Department, Course Number (& Unit Value)	Overall Satisfaction							Applic/Relev to Intr Areas							Approp No. of Units for Course*							
	V Low	Low	In Btw	Hi	V Hi	Mean	N	V Low	Low	In Btw	Hi	V Hi	Mean	N	1	2	3	4	5	6	Mean	N
M.E. 104A (4)	10%	19%	37%	28%	4%	2.97	67	19%	31%	34%	10%	4%	2.49	67	---	---	3%	82%	15%	---	4.12	65
C.E. 118 (3)	---	10	23	48	19	3.73	48	8	8	27	38	19	3.50	48	---	2%	77	21	---	---	3.19	48
C.E. 130A (4)	6	4	26	46	18	3.63	66	2	9	24	41	24	3.77	66	---	---	---	61	38	2%	4.41	64
C.E. 165A (3)	14	20	34	25	6	2.89	64	11	34	31	14	9	2.77	64	---	---	66	33	2	---	3.36	61
C.E. 110 (3)	7	14	37	31	12	3.27	59	3	8	29	37	22	3.66	59	---	---	53	47	---	---	3.47	57
C.E. 121 (4)	2	6	23	30	19	3.79	52	2	13	9	47	28	3.87	53	---	---	14	86	---	---	3.86	52
C.E. 131 (4)	2	2	23	46	27	3.95	56	2	11	25	23	39	3.88	56	---	---	2	60	38	---	4.36	55
C.E. 165B (3)	18	12	43	26	2	2.82	51	22	33	22	12	12	3.39	51	---	2	74	24	---	---	3.22	49
C.E. 133 (4)	---	5	37	45	13	3.66	38	3	3	32	24	40	3.95	38	---	---	5	58	37	---	4.32	38
C.E. 134 (4)	---	8	54	23	15	3.46	13	---	---	31	15	54	4.23	13	---	---	7	86	7	---	4.00	13
C.E. 140 (4)	5	19	35	32	8	3.19	37	14	43	24	11	8	2.57	37	---	---	25	75	---	---	3.75	36
C.E. 170 (4)	35	16	30	16	3	2.35	37	32	16	34	13	5	2.45	38	---	---	3	74	23	---	4.21	39
C.E. 141 (3)	9	18	21	50	3	3.21	34	26	31	17	17	9	2.31	35	---	---	56	44	---	---	3.44	34
C.E. 192 (1)	---	11	24	46	19	3.73	37	3	9	20	37	31	3.86	35	87%	14	---	---	---	---	1.14	37
C.E. 194 (3)	4	9	22	48	17	3.65	23	---	4	28	28	40	4.04	25	---	---	4	44	52	---	4.48	25

*This rating was of the fill-in type, where respondents wrote in the appropriate number of units for the course. All values that were written in but were more than two units higher than the actual unit value of the course being rated were reduced to (unit value + 2) before keypunching and data analysis.

MATERIALS SCIENCE AND ENGINEERING SUPPLEMENT

	Str Disag	Disag	In Btwn	Agree	Str Agree	Mean	N.
3. A technical writing course should be required of all majors/ double majors in MSE.	-----	5%	5%	50%	40%	4.25	20
4. FOR DOUBLE MAJORS IN MATERIALS SCIENCE AND ENGINEERING:							
A. The coursework for both of my majors overlaps very little.	-----	18	36	27	18	3.46	11
B. The coursework for both of my majors is complementary, resulting in an effective synthesis of the two programs.	-----	18	27	54	-----	3.36	11
C. One of my majors is too theoretical and the other is too applied.	-----	42	50	8	-----	2.67	12
D. With faculty from the MSE Department acting as guest lecturers, the content in some of the courses in my other major could be taught more effectively.	9%	27	27	27	9	3.00	11

MATERIALS SCIENCE AND ENGINEERING SUPPLEMENT
(continued)

Department, Course Number and Title

Electrical Engineering and Computer Science 109, Electronic Circuits and Instrument Systems
Civil Engineering 110, Properties of Structural Materials
Engineering 145, Mechanical Properties of Structural Metals and Alloys
Civil Engineering 130A, Mechanics of Materials
Materials Science and Engineering 100, Field Trips
Materials Science and Engineering 101, Crystal Chemistry and Diffraction
Materials Science and Engineering 101L, Crystal Chemistry and Diffraction Lab
Materials Science and Engineering 102, Thermodynamics
Materials Science and Engineering 103, Phase Equilibria and Transformations
Materials Science and Engineering 103L, Phase Equilibria and Transformations Lab
Materials Science and Engineering 107, Chemical Metallurgy
Materials Science and Engineering 108, Electric and Magnetic Materials
Materials Science and Engineering 109, Physical Metallurgy
Materials Science and Engineering 109L, Physical Metallurgy Lab
Materials Science and Engineering 121, Glass and Crystalline Ceramic Materials
Materials Science and Engineering 121L, Glass and Crystalline Ceramic Materials Lab
Materials Science and Engineering 122, Ceramic and Metal Powder Processing
Materials Science and Engineering 122L, Ceramic and Metal Powder Processing Lab
Materials Science and Engineering 141, Particulate Materials
Materials Science and Engineering 141L, Particulate Materials Lab
Materials Science and Engineering 142, Materials Process Engineering

Department, Course Number (4 Unit Value)	Overall Satisfaction							Applic/Relev to Instr Areas							Approp No. of Units for Course*							
	V Low	Low	In Btw	Hi	V Hi	Mean	N	V Low	Low	In Btw	Hi	V Hi	Mean	N	1	2	3	4	5	6	Mean	N
EECS 109 (4)	25%	62%	12%	---	---	1.88	8	25%	25%	25%	12%	12%	2.62	8	---	---	25%	63%	12%	---	3.88	8
C.E. 110 (3)	---	67	---	---	33%	3.00	3	---	---	67	---	33	3.67	3	---	---	---	100	---	---	4.00	3
ENGG 145 (3)	---	---	14	14%	71	4.57	7	---	---	---	29	71	4.71	7	---	---	57	29	14	---	3.57	7
C.E. 130A (4)	---	---	50	36	14	3.64	14	---	---	36	43	21	3.86	14	---	---	---	36	64	---	4.64	14
MSE 100 (2)	---	---	20	40	40	4.20	5	20	---	20	40	20	3.40	5	---	80%	---	20	---	---	2.40	5
MSE 101 (3)	6	11	44	28	11	3.28	18	---	6	33	33	28	3.83	18	---	6	44	39	11	---	3.56	18
MSE 101L (1)	6	11	22	33	28	3.67	18	---	11	33	28	28	3.72	18	17%	50	28	6	---	---	2.22	18
MSE 102 (4)	9	36	46	---	9	2.64	11	---	18	64	9	9	3.09	11	---	---	18	82	---	---	3.82	11
MSE 103 (3)	---	7	43	36	14	3.57	14	---	---	43	36	21	3.79	14	---	---	79	14	7	---	3.29	14
MSE 103L (1)	21	14	36	21	7	2.79	14	14	7	36	21	21	3.29	14	71	14	7	7	---	---	1.50	14
MSE 107 (4)	11	---	33	33	22	3.56	9	---	11	33	33	22	3.67	9	---	---	11	78	11	---	4.00	9
MSE 108 (4)	40	30	30	10	---	2.10	10	10	10	10	40	30	3.70	10	---	---	10	70	20	---	4.10	10
MSE 109 (3)	---	33	33	---	33	3.33	3	---	---	---	33	67	4.67	3	---	---	33	---	33	33%	4.67	3
MSE 109L (1)	---	---	33	33	33	4.00	3	---	---	---	33	67	4.67	3	33	33	33	---	---	---	2.00	3
MSE 121 (3)	---	23	54	23	---	3.00	13	---	8	62	15	15	3.38	13	---	---	85	8	8	---	3.23	13
MSE 121L (1)	23	46	15	15	---	2.23	13	8	23	46	15	8	2.92	13	83	---	8	8	---	---	1.42	12
MSE 122 (3)	---	---	60	40	---	3.40	5	---	---	60	20	20	3.60	5	---	---	60	20	20	---	3.60	5
MSE 122L (1)	---	---	25	75	---	3.75	4	---	---	25	50	25	4.00	4	75	---	25	---	---	---	1.50	4
MSE 141 (3)	---	17	17	50	17	3.67	6	17	---	17	33	33	3.67	6	---	---	50	33	17	---	3.67	6
MSE 141L (1)	---	---	33	33	33	4.00	6	---	17	33	17	33	3.67	6	50	17	17	17	---	---	2.00	6
MSE 142 (4)	---	50	33	---	17	2.83	6	17	17	17	17	33	3.33	6	---	---	67	17	17	---	3.50	6

*This rating was of the fill-in type, where respondents wrote in the appropriate number of units for the course. All values that were written in but were more than two units higher than the actual unit value of the course being rated were reduced to (unit value + 2) before keypunching and data analysis.

	Str Disag	Disag	In Btwn	Agree	Str Agree	Mean	N.
2. M.E. 107B should be replaced by a class on technical report-writing, so that the sequence would be: 107A--experimentation and instrumentation; 107B--report writing and research techniques; 107C--Laboratory.	18%	18%	20%	26%	20%	3.12	51
3. An undergraduate degree should continue to ensure competency in all the diverse subfields of M.E. rather than permitting students to specialize more extensively in one or two areas within the required courses.	4	26	15	40	15	3.37	78
4. Too many M.E. classes are taught as if I knew essential background material from other courses not listed as prerequisites (or even as recommended).	9	47	24	18	2	2.58	79
5. I would be willing to spend two to three hours per week as a student member/representative on a departmental faculty committee.	14	28	21	22	15	2.98	80

5--Appendix B

MECHANICAL ENGINEERING SUPPLEMENT
(continued)

Department, Course Number and Title

Mechanical Engineering 102A, Mechanical Behavior and Processing of Materials
Mechanical Engineering 104A, Engineering Mechanics II
Mechanical Engineering 104B, Engineering Mechanics III
Mechanical Engineering 105A, Thermodynamics
Mechanical Engineering 105B, Thermodynamics
Mechanical Engineering 106A, Fluid Mechanics and Transport Processes
Mechanical Engineering 108, Introduction to Dynamic Systems
Civil Engineering 130A, Mechanics of Materials
Electrical Engineering and Computer Science 100A, Electric Circuits, Electronics and Instrumentation
Electrical Engineering and Computer Science 100B, Electric Circuits, Electronics and Instrumentation
Mechanical Engineering 102B, Mechanical Engineering Design
Mechanical Engineering 106B, Fluid Mechanics and Transport Processes
Mechanical Engineering 107A, Experimentation and Measurement
Mechanical Engineering 107B, Mechanical Engineering Phenomena Lab
Mechanical Engineering 107C, Mechanical Engineering Systems Lab

Department, Course Number (& Unit Value)	Overall Satisfaction							Applic/Relev to Intr Areas							Approp No. of Units for Course*							
	V Low	Low	In Btw	Hi	V Hi	Mean	N	V Low	Low	In Btw	Hi	V Hi	Mean	N	1	2	3	4	5	6	Mean	N
M.E. 102A (4)	5%	7%	29%	36%	24%	3.67	42	2%	2%	20%	27%	49%	4.17	41	---	---	5%	73%	22%	---	4.17	41
M.E. 104A (4)	3	11	36	39	12	3.47	75	3	11	28	39	19	3.61	74	---	---	9	85	5	---	3.96	75
M.E. 104B (3)	12	17	34	29	8	3.03	65	8	20	23	34	14	3.27	64	2%	3%	33	56	6	---	3.62	76
M.E. 105A (4)	8	12	34	29	16	3.33	73	3	12	33	29	22	3.56	72	---	---	3	94	3	---	4.00	72
M.E. 105B (3)	6	14	32	28	20	3.42	71	1	9	37	26	27	3.69	70	1	1	22	68	7	---	3.78	71
M.E. 106A (4)	2	8	36	48	6	3.48	50	---	8	34	46	12	3.62	50	---	---	8	92	---	---	3.92	50
M.E. 108 (3)	---	25	25	38	12	3.38	12	---	12	38	25	25	3.62	12	---	---	56	33	11	---	3.56	9
C.E. 130A (4)	4	8	26	44	17	3.61	72	3	11	27	30	30	3.72	71	1	3	68	22	6	---	4.27	71
EECS 100A (3)	11	12	28	32	17	3.32	65	6	20	31	33	9	3.19	64	---	5	37	55	3	---	3.57	63
EECS 100B (3)	18	12	25	32	12	3.10	40	10	10	36	26	18	3.31	39	---	5	39	56	---	---	3.51	41
M.E. 102B (4)	2	8	12	32	45	4.10	40	2	2	20	25	50	4.18	40	---	5	2	64	29	---	4.17	42
M.E. 106B (3)	---	3	44	41	12	3.62	32	---	6	38	35	21	3.71	34	---	3	37	60	---	---	3.57	35
M.E. 107A (4)	22	13	17	30	17	3.09	23	21	8	21	29	21	3.21	24	---	4	12	79	4	---	3.83	24
M.E. 107B (4)	17	3	34	41	3	3.10	29	10	7	20	50	13	3.50	30	---	3	3	64	23	6%	4.26	31
M.E. 107C (4)	22	---	44	33	---	2.89	9	10	10	20	40	20	3.50	10	---	---	---	64	27	9	4.46	11

*This rating was of the fill-in type, where respondents wrote in the appropriate number of units for the course. All values that were written in but were more than two units higher than the actual unit value of the course being rated were reduced to (unit value + 2) before keypunching and data analysis.

CHEMICAL ENGINEERING SUPPLEMENT

	Str Disag	Disag	In Btwn	Agree	Str Agree	Mean	N.
1. Chemistry 5 (Quantitative Analysis) should continue to be a requirement for Chemical Engineering majors.	13%	21%	13%	42%	11%	3.17	53
2. For those who took Chemistry 14 (Chemical Thermodynamics) at Berkeley: Chem 14 adequately prepared me for Chemical Engineering 141A (Chem E. Thermodynamics).	9	13	9	50	20	3.59	46
3. Chemistry 110A (Physical Chemistry) should continue to be a requirement for Chemical Engineering majors.	25	20	19	29	7	2.71	55
4. Chemistry 111 (Physical Chemistry Lab) should continue to be a requirement for Chemical Engineering majors.	9	13	15	43	20	3.52	54
5. Chemical Engineering 150 (Fluid Mechanics and Heat Transfer) should be split into two courses.	5	12	19	30	33	3.74	57
6. Assuming Chemical Engineering 150 is split into two courses:							
A. Fluid Mechanics should be taught in the Chemical Engineering Department.	4	2	11	42	42	4.16	55
B. Heat Transfer should be taken in the Mechanical Engineering Department.	34	15	21	19	11	2.58	53
7. Chemical Engineering 151A and 151B (Chemical Engineering Lab, each 4 units) should be combined into a single course of 6 units. [Assume the current, six written experiments with 3-person teams are reduced to four with 2-person teams.]	43	25	4	14	14	2.30	44
8. For those who have taken Chemical Engineering 151: The course adequately prepared/prepares me for writing reports in a professional capacity.	4	11	14	46	25	3.79	28
9. For those who have <u>not</u> yet taken Chem E. 151A: I am fully aware that if I do not pass an expository writing exam given by the Department that I will be required to take a technical writing course before enrolling in Chem E. 151A.	9	-----	-----	41	50	4.22	32
10. If only some Chemical Engineering majors are required to take a technical writing course (while others pass a test), those taking the course should be able to count it as a technical elective should they so desire.	18	18	7	31	26	3.27	55

		Str Disag	Disag	In Btwn	Agree	Str Agree	Mean	N.
11.	Because Chemical Engineering 151 (Chem E. Lab) requires an oral presentation too, there should be an oral component of Chem E. 195 (the technical writing course).	9%	13%	13%	40%	24%	3.57	53
12.	A technical writing course should be required of all Chem E. majors.	4	23	19	16	39	3.63	57
13.	The Department should finalize its policies about Chem E. 195 (technical writing course) and put the information clearly in the College of Chemistry Announcement.	2	2	7	32	57	4.41	56
14.	Laboratory exposure to fluid flow, heat transfer, mass transfer and measurement techniques should accompany the lectures in Chem E. 150 (Fluid Flow and Heat Transfer) and Chem E. 153 (Mass Transfer).	4	12	14	52	19	3.71	52
15.	Chemical Engineering 162 (Dynamics and Control of Chemical Processes) should be a required course, and not just an elective, for all Chem E. majors.	-----	20	20	34	26	3.66	35
16.	Chemical Engineering majors should be required (and not just strongly recommended) to take one or more specific courses in other Engineering Departments.	11	30	23	21	14	2.98	56
17.	I would be interested in taking some advanced electives in chemical engineering which are not currently offered at the undergraduate level by the Department.	8	12	22	34	24	3.54	50
18.	I would be interested in taking some advanced graduate seminars (e.g., in the 295 series) if the Department clearly welcomed undergraduates in the courses. [Sample 295 topics include: Food Process Engineering; Energy Resources and Production; Chemical Technology of Air Pollution Abatement; Thin Film Technology; Special Topics in Energy Conversion.]	2	6	8	35	49	4.24	56
19.	The Chemical Engineering Department should be in the College of Engineering.	50	21	10	10	10	2.08	52
20.	The Department should do its best to accomodate all students who are interested in majoring in Chemical Engineering.	4	11	30	30	26	3.65	57
21.	The Department should accept fewer students into the Chemical Engineering major.	19	19	35	18	9	2.77	57

22. If the Department decides to lower the number of students in the major, how do you feel about the inclusion of each of the following possible criteria among those to be used in making decisions about admission to or retention in the Department's undergraduate program?

	Do Not Use at All	Use a Little	Use Some	Use Much	Use as Much as Pos.	Mean	N.
A. Extra-rigorous grading (to discourage or even fail some students).	51%	20%	20%	5%	3%	1.90	57
B. Increase student workload per unit of coursework (e.g., to deter interest).	66	22	10	2	------	1.48	58
C. Require all students to study a minimum of 4 courses per quarter (except if they are working more than 12 hours per week at a job, or have equivalent outside responsibilities).	49	19	17	7	9	2.07	54
D. Require a higher-than-minimum grade in UCB's Chemical Engineering 140 (e.g., a "B-" instead of a "C+" or "C-").	40	16	14	22	9	2.45	58
E. High School Grade-Point-Average (GPA)--used for students applying directly from high school and intending to major in Chemical Engineering.	19	22	22	14	22	2.98	58
F. Test scores (S.A.T., etc.)--used for students applying directly from high school and intending to major in Chemical Engineering.	33	28	16	10	14	2.45	58
G. GPA for all courses taken at Berkeley--used for students who have been at UCB for two or more quarters.	15	27	29	20	9	2.80	54
H. GPA for courses taken at other colleges/universities--used for students who have not been at UCB for at least two quarters [applied typically at the time of application for transfer to Berkeley].	9	32	29	20	10	2.92	53
I. Affirmative-action related criteria (e.g. to foster a long-term balance in the profession and student body of underrepresented groups such as women, some ethnic minorities, students from low-income backgrounds). [Quotas are prohibited; this criterion could not be used exclusively.]	49	21	19	7	4	1.95	57
J. A special test administered on application to the major after completion of lower division requirements. [The test might be limited to two tries per applicant; transfer students might be tested prior to their admission.]	28	24	22	19	7	2.53	58

CHEMICAL ENGINEERING SUPPLEMENT
(continued)

Department, Course Number and Title

Chemistry 110A, Physical Chemistry
Chemistry 110C, Physical Chemistry
Chemistry 111A, (If New Version), Physical Chemistry Lab
Chemistry 111A, (If Older Version), Physical Chemistry Lab
Chemistry 111B, (Older Version), Physical Chemistry Lab
Chemical Engineering 140, Elements of Chemical Process Analysis
Chemical Engineering 141A, Chemical Engineering Thermodynamics
Chemical Engineering 142, Chemical Kinetics of Industrial Processes
Chemical Engineering 150, Fluid Flow and Heat Transfer Processes
Chemical Engineering 151A, Chemical Engineering Lab
Chemical Engineering 151B, Chemical Engineering Lab
Chemical Engineering 152, Seperation Processes
Chemical Engineering 153, Mass Transfer Processes
Chemical Engineering 160, Chemical Process Design
Chemical Engineering 195, Technical Writing Skills
The Introductory Computer Science Courses You Have Taken, Iff Self-Paced (e.g., 1S, 3S, 101S, 103S)
The Introductory Computer Science Courses You Have Taken, Iff Not Self-Paced (e.g., 1, 3, 101, 103)

Department, Course Number (& Unit Value)	Overall Satisfaction							Applic/Relev to Intr Areas							Approp No. of Units for Course*							
	V Low	Low	In Btw	Hi	V Hi	Mean	N	V Low	Low	In Btw	Hi	V Hi	Mean	N	1	2	3	4	5	6	Mean	N
Chem 110A (2)	19%	33%	25%	21%	2%	2.54	52	35%	38%	19%	4%	4%	2.04	52	---	21%	56%	23%	---	---	3.02	52
Chem 110C (4)	14	14	40	23	9	2.97	35	11	31	31	17	9	2.80	35	---	---	26	66	6%	3%	3.86	35
Chem 111A (new-4)	---	29	38	24	10	3.14	21	10	19	29	33	10	3.14	21	---	---	---	62	33	5	4.43	21
Chem 111A (old-3)	11	18	30	33	7	3.07	27	22	22	33	11	11	2.67	27	---	---	62	31	4	4	3.50	26
Chem 111B (old-3)	7	26	22	33	11	3.15	27	22	22	26	18	11	2.74	27	---	---	62	31	4	4	3.50	26
Chem E 140 (4)	6	8	28	34	24	3.64	53	---	4	18	43	35	4.09	53	---	---	8	74	19	---	4.11	53
Chem E 141A (4)	12	5	30	40	14	3.40	43	2	11	16	30	21	3.75	44	---	---	5	86	7	2	4.07	42
Chem E 142 (4)	10	10	30	33	17	3.37	30	10	7	13	43	27	3.70	30	---	---	10	83	7	---	3.97	30
Chem E 150 (4)	4	18	16	45	18	3.55	51	---	6	8	38	48	4.29	52	---	---	---	68	28	4	4.36	50
Chem E 151A (4)	---	7	29	25	39	4.06	28	---	---	10	34	55	4.45	29	---	---	---	55	34	7	4.59	29
Chem E 151B (4)	---	4	29	29	38	4.00	24	---	---	12	38	50	4.38	24	---	---	---	58	29	12	4.54	24
Chem E 152 (3)	---	---	26	41	32	4.06	34	---	---	15	47	38	4.24	34	---	---	26	68	6	---	3.80	34
Chem E 153 (4)	8	8	23	42	19	3.58	26	---	8	23	31	38	4.00	26	---	---	---	69	31	---	4.31	26
Chem E 160 (4)	---	---	---	71	29	4.30	17	---	---	18	35	47	4.30	17	---	---	---	61	33	6	4.44	18
Chem E 195 (3)	---	---	8	46	46	4.38	13	---	---	8	61	31	4.23	13	---	31	62	8	---	---	2.77	13
Intro C.S., (4) iff self-paced	9	14	14	41	23	3.54	22	---	---	9	46	46	4.36	22	---	---	6	82	12	---	4.06	17
Intro C.S., (4) iff not self-paced	---	10	40	25	25	3.65	20	---	---	20	50	30	4.10	20	---	---	5	63	26	5	4.32	19

*This rating was of the fill-in type, where respondents wrote in the appropriate number of units for the course. All values that were written in but were more than two units higher than the actual unit value of the course being rated were reduced to (unit value + 2) before keypunching and data analysis.

APPENDIX C
THE COVER LETTERS AND QUESTIONNAIRES

The ordering of Appendix C, which provides copies of the materials sent to students in the sample (except as cited in #5 below), is as follows:

1) The cover letter(s) and their "Appendix A." The cover letter comes in two versions (both with Appendix A on the reverse side), one for students in the six College of Engineering programs and Chemical Engineering, and one for physical science majors in the College of Letters & Science (including Computer Science) and Chemistry.

2) The second cover note. This note was sent, together with a second copy of all materials originally sent (using the same student identification number), to all students in the sample who did not respond to the first mailing by the end of Winter Quarter 1980--if the ARU had not received an indication from the Post Office that the student had "Moved--Left No Address."

3) The Undergraduate Major Program Evaluation Questionnaire (UMPEQ)--4 pages. This questionnaire was sent to all students in the sample.

4) The Engineering Supplement (ESQ)--2 pages. This questionnaire was sent to all students in the engineering sample (see #1 above).

5) The four departmental supplements were sent only to the students enrolled in the appropriate department (or double major). Because the results presented in Appendix B and the format of the UMPEQ and ESQ are indicative of the nature of the departmental supplements, these 10 pages of questionnaires are not included in their original form in Appendix C. The explanations following below, which complete the depiction begun in Appendix B, should suffice to give an adequate understanding.

The Departmental Supplements. In elaboration of Point #5 above:

a) The departmental supplements were titled: Civil Engineering Supplement; Supplement for Majors and Double Majors in Materials Science and Engineering; Mechanical Engineering Supplement; and Chemical Engineering Supplement.

b) The format for the questions employing a 1-5 scale ranging from Strongly Disagree to Strongly Agree is the same as in the UMPEQ and ESQ. The item wordings are quoted in Appendix B.

c) The item which requested three types of course ratings (CEQ #6, MSEQ #1, MEQ #1, ChEQ #23*) reads as follows:

1. For each of the following courses which you have taken at Berkeley, please rate your overall satisfaction with the course and its applicability or relevance to your areas of interest in the field; also, please fill in the number of units you feel are appropriate to assign to the course as currently offered.

   For the first two parts of the question, please use the following scale to insert your ratings on the spaces provided:

   1= Very Low
   2= Low
   3= In Between
   4= High
   5= Very High
   0= Have Not Taken Course at UCB

Course Number, Title and (Unit Value)	[Insert ratings for] Overall Satisfaction	[Insert ratings for] Applicability or Relevance to Your Areas of Interest	[Please fill in] The Appropriate Number of Units for this Course

d) Each of the questionnaires included an invitation to make/enclose additional comments. Limitations on ARU time and space (report length), as well as the relatively small number of responses, precluded the inclusion of open-ended comments (to any of the questionnaires).

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*The Chemical Engineering Supplement's Question #23 included provision to fill-in and rate two Chemical Engineering electives, and no one course thus rated had been taken by as many as 12 students. (The respondents may have assumed that only upper division courses should be filled-in.) Also in the ChEQ, the words "which you have taken at Berkeley" were not underlined.

Dear Fellow Engineering Student,

The enclosed questionnaire is designed to provide you with a real opportunity to express your views and feelings about your educational program at Berkeley. While not every question will be applicable to every student's program, many of the survey items have been designed by and for Engineering students.

The main purpose of this questionnaire evaluation is to identify the strengths and weaknesses in the Engineering and Physical Sciences programs at UCB. The goals are to encourage departments/programs to improve offerings where they are weak, to find what works well (as models for other programs), and to give credit where it is due.

To help ensure that the results of your efforts are taken seriously, a full report of the findings will be sent to every regular faculty member in Engineering as well as to the appropriate U.C. Administrators and faculty Senate committees.

YOUR RESPONSES ARE ENTIRELY CONFIDENTIAL.*

A response from each of you is essential--in order to obtain a good cross section of student views, to ensure the representativeness of the data, and to help gain full faculty consideration of the results of the evaluation. We apologize for the length of the questionnaire, but feel that completeness in the assessment is important in this unique opportunity to compile views of students across several Engineering programs. So please use your next free 40 minutes (or so) to answer the questionnaire. A postage-prepaid, return envelope is provided.

The evaluation is sponsored by the Engineers Joint Council (EJC), with the support of the ASUC Academic Review Unit (ARU). Previous ARU reports provide convincing evidence of their competence (see reverse side). The EJC will have final approval of any recommendations actually included in the report, and we welcome your participation in the consideration of the findings. (Preliminary results may be available late in the Spring Quarter, and the final compilation, with the results systematically laid out in tables, will be ready next Fall.)

THANK YOU VERY MUCH FOR YOUR HELP.

Sincerely yours,

Bill Johnson

Bill Johnson
EJC President

*Please see Appendix A, on the reverse side of this letter, for more information about the confidentiality procedures, why the questions are worded as they are, and the Academic Review Unit.

3--Appendix C

APPENDIX A

(see cover letter on reverse side)

Confidentiality Procedures

The "Department/Individual Identification Number" on the questionnaire is only to check off who has responded when questionnaires are returned, so we can send a second mailing to persons who do not respond fairly soon (and avoid duplicate responses in the process). Please save us the time and money involved in a second mailing by responding as soon as you can. After responses stop coming in, we will destroy the number code on our name list, thus rendering your individual questionnaire untraceable to you.

Additional Student Comments

PLEASE FEEL FREE TO COMMENT IN THE MARGINS ON ANY ITEM, OR ADD AN EXTRA SHEET OF COMMENTS IN THE PREPAID RETURN ENVELOPE. If you do not want your comments typed for possible inclusion anonymously in an appendix to the final report, simply indicate as much.

Item Wording

Some of the items in the questionnaire could also be termed "propositions"--they make a statement, occasionally a strong statement, and ask you to agree or disagree with it. The important thing is not so much how the item is worded, however, but with the strength of agreement or disagreement by the respondents (you). This approach allows items to be worded from a variety of philosophical perspectives. But please feel free to use the response category "Don't Know or Not Applicable" as needed. (Items with a high rate of nonresponse, even 10-20%, often do not allow any firm conclusions to be drawn about the results, and we will exercise appropriate care in this regard.)

In general, the survey items have been phrased with two important questions in mind:

1) Is the item worded such that student responses will make a clear and meaningful statement about education in their program or across a whole area of study? This approach has provided results more useful than would asking you a lot of bland questions, and is often used in survey research (e.g., by the Carnegie Commission on Higher Education). The approach allows the items to be focused precisely on areas of potential student needs.

2) Will students' responses to an item be likely to differ from one major to another? Or will they differ according to students' goals in college, by transfer or nontransfer student status, and so on? Where such differences in students' responses occur, there is often a real possibility for improvement in the educational process. For example, if UCSC is rated as better than U.C. at meeting some student needs, but not others, there may well be the potential for both to improve, at least to the level of the other, where they seem weaker.

The Academic Review Unit (ARU)

The Academic Review Unit (ARU) is charged with helping to collect/provide student input, particularly at the undergraduate level, concerning the effectiveness of the educational programs at Berkeley. Our view is that no program can be evaluated fairly or completely without inclusion of students' perspectives in the analysis, and in the decisions that result from the evaluation.

The ARU has been operating successfully for 6 years. We are a project of the ASUC Academic Affairs Office (along with Primar and Mini-Grants), run by and for students. Our work is evaluated by students (current and prospective users of ARU support services), faculty in programs evaluated (via a "feedback questionnaire"), a faculty Senate committee (with student members), and by program and campus administrators. The ARU is especially respected for the careful presentation of data in its reports--in ways which also allow the reader to draw his/her own conclusions. The funding for the ARU comes through the Vice Chancellor's Office, on recommendation of the faculty Senate committee, from money obtained for the University by the U.C. Student Lobby (which is directed by the undergraduate and graduate student body presidents from all nine U.C. campuses, and supported in part by your ASUC fees, as appropriated by the ASUC Senate).

Examples of Previous ARU Work

All previous ARU program evaluation reports are available for your inspection at the office (208/214 Eshleman).

The Undergraduate Major Program Evaluation Questionnaire, an updated version of which is included in this letter, was first developed by a committee of students for the 1977 ARU reviews (see below), and in the last 3 years has been answered by over 1500 students in 15 departments. The response rates to the 1977 and 1979 surveys of upper division majors and the 1978 survey of lower division students ranged from 33-40%--rates which are considered fairly good. But the higher the response rate, the more valid the results will be, and the more likely it is that the University will recognize that students do want their input about their programs to be taken seriously.

In recent years, the ARU has surveyed students and compiled reports of the evaluation for all of UCB's life-related sciences programs (1977), 7 selected humanities departments (1977), lower division education in all five "Colleges" at UCB (1978), and all of the social science-related programs (1979). Evaluations have also been ARU-supported or sponsored in individual departments and programs. Examples include French (including graduates), Chicano Studies Program (alumni), Biology (including alumni), Zoology, Subject A, Spanish and Art History (including graduates). The ARU has also reported on the situation generally for students in the pre-health sciences.

ARU reports from 1974-76 include: Mathematics, Social Welfare, Political Science, Journalism, and Law and Society.

For Further Information

If you would like more information on the ARU's work, or about this program evaluation survey, please feel free to call Jeff Koon at 642-0256. If necessary, please leave a message with your phone number and the best times to call you back (I only work half-time, including some nights).

Winter-Spring 1980

Dear Physical Science Student,

The enclosed questionnaire is designed to provide you with a real opportunity to express your views and feelings about your educational program at Berkeley. Many items address key areas of concern to students (though not every question will be applicable to every student's program).

The main purpose of this survey evaluation is to identify the strengths and weaknesses in the Physical Sciences and Engineering programs at UCB. The goals are to encourage departments/programs to improve offerings where they are weak, to find what works well (as models for other programs), and to give credit where it is due.

To help ensure that the results of your efforts are taken seriously, a full report of the findings will be sent to all department/program chairpersons and to appropriate administrators and faculty committees of the Department, College and Senate. All Physical Sciences and Engineering faculty members will receive a copy of the report or notice of its availability.

YOUR RESPONSES ARE ENTIRELY CONFIDENTIAL.*

A response from each of you is essential—in order to obtain a good cross section of student views, to ensure the representativeness of the data, and to help gain full faculty consideration of the results of the evaluation. This is a unique opportunity to compile and compare views of students across Physical Sciences and Engineering programs. So please use your next free 20 minutes (or so) to answer the questionnaire. A postage-prepaid, return envelope is provided.

The evaluation is sponsored by the ASUC Academic Review Unit* (and, in its Engineering components, by the Engineers Joint Council, the umbrella organization of the student-professional societies in the engineering departments, for which there is no parallel in the Physical Sciences). Copies of the report, with the results systematically laid out in tables, will be available free to respondents and be sent to undergraduate organizations and secretaries (for check out). General notice of the report's availability also will be published in the Daily Californian.

THANK YOU VERY MUCH FOR YOUR HELP.

Sincerely yours,

Jeff Koon

Jeff Koon
Academic Review Unit Coordinator
ASUC Academic Affairs Office
208/214 Eshleman Hall
University of California
Berkeley, CA 94720

*Please see Appendix A, on the reverse side of this letter, for more information about the confidentiality procedures, why the questions are worded as they are, and the Academic Review Unit.

5--Appendix C

Spring 1980

Dear Engineering and Physical Sciences Students,

BACK TO YOU with a second PLEAse--to take the time to respond to the enclosed program evaluation survey.

Thus far, the response rate is running 35-40%, but that's still not high enough to ensure that the responses from your program are pretty fully representative or that YOUR VIEWS are adequately represented.

You will probably even ENJOY and BENEFIT from the experience--the questionnaire offers you a good once-over through your University education.

How can a University evaluate its programs without taking full account of the perspectives of students--those most affected by the educational process? Moreover, many faculty members are looking forward to seeing the results, as evidenced by comments received when we sent the semi-final draft of the questionnaire to them for review and comment:

> "This is the kind of help we need to improve the quality of education at Berkeley. Good luck." Prof. Karl Pister, Chairman, Assembly of the Academic Senate [Statewide faculty Senate].
>
> "In keeping with the general tradition in Engineering of responsiveness to our various clientales, I believe this evaluation offers good prospects for an improved understanding of Engineering students' perceptions of their program." Dean Ernest S. Kuh, College of Engineering.
>
> "In general, the project looks like a good idea. I will be glad to support it." Prof. C. Judson King, Chairman, Chemical Engineering (College of Chemistry).
>
> "I wish you luck, and will look forward to the results." Prof. Walter Alvarez, Geology and Geophysics (College of Letters and Science).
>
> "The questions cover all subjects on [which] I would be interested in getting student feedback." Prof. Donald Sakrison, Chairman, Electrical Engineering and Computer Sciences.

As these excerpts show, a high response rate will help to ensure that the results will be taken seriously by the University. But supportive faculty and your student organization, departmental committee representatives, or the classes of 1981 and beyond may not have enough to go on if you don't help.

So if you're tied up studying, or otherwise, please take a longer break next time and fill out this survey. We again apologize for the questionnaire's length, but the responses to EVERY ITEM will be REPORTED for EVERY PROGRAM evaluated!

Once again,

THANK YOU VERY MUCH,

Jeff Koon

Jeff Koon
Academic Review Unit Coordinator

UNDERGRADUATE MAJOR PROGRAM EVALUATION QUESTIONNAIRE

Academic Review Unit
ASUC Academic Affairs Ofc.
208 Eshleman Hall
642-0256

Program/Individual Identification Number*

1. In what department(s) or program(s) are you enrolled? _____ (1-3)
[Note: If you are enrolled in a particular plan, option, or specialization within your major program, or in a double major, please indicate that here too, and answer the questions as applied to that program, collection of courses, etc.]

2. Year in school: 1[ ] Frosh 2[ ] Soph 3[ ] Junior 4[ ] Senior 5[ ] Grad 6[ ] Other: Limited Status (6)

3. Including the Winter Quarter of 1980, how long have you been at UCB? 1[ ] 3 or fewer quarters (7)
2[ ] 4-6 quarters 3[ ] 7-9 quarters 4[ ] 10-12 quarters 5[ ] 13 or more quarters

4. School or college of attendance immediately prior to UCB: 1[ ] High school (8)
2[ ] Two-year (e.g., community) college 3[ ] Other U.C. campus
4[ ] Other university or four-year college 5[ ] Other

5. What is the highest level of education you expect to attain in the next 10 years?
1[ ] Bachelor's degree 2[ ] Teaching credential (elementary, secondary) 3[ ] Master's degree (9)
4[ ] Ph.D. or higher professional degree (e.g., D.E., M.D., J.D., Ed.D., D.S.W., etc.)

6. Sex: 1[ ] Male 2[ ] Female (10)

7. Ethnic identification: 1[ ] Black/Afro-American 2[ ] White/Caucasian 3[ ] Chicano/Mexican-American (11)
4[ ] Latino 5[ ] Chinese/Chinese-American 6[ ] Japanese/Japanese-American
7[ ] Filipino/Philippine-American 8[ ] Other Asian, Oceanic, Arab, or Iranian
9[ ] Native American (nonCaucasian) 0[ ] Decline to state

8. Where do you live while attending Berkeley? 1[ ] U.C. dormitory or other U.C. housing (12)
2[ ] Fraternity or sorority 3[ ] Cooperative housing (U.S.C.A.)
4[ ] At home with parents, or with relatives 5[ ] Apartment, house, hotel; OR your own home
6[ ] Other; please specify: _____

9. How many units did you take in Fall 1979? 0[ ] Zero units 1[ ] 1-5 2[ ] 6-10 3[ ] 11-13 (13)
4[ ] 14-16 5[ ] 17-19 6[ ] 20-22 7[ ] 23 or more units

10. During Fall Quarter 1979, for how many hours per week were you in paid employment? 0[ ] Zero hours per week (14)
1[ ] 1-5 2[ ] 6-10 3[ ] 11-15 4[ ] 16-20 5[ ] 21-30 6[ ] 31 or more hours per week

11. During Fall Quarter 1979, about how many hours per week did you study outside of class and lab? (Please include time spent in serious discussions about course materials and study sessions with peers; writing and reading for papers and reports; doing problem sets; overtime spent in lab; etc.)
00[ ] Zero hours per week 01[ ] 1-5 02[ ] 6-10 03[ ] 11-15 04[ ] 16-20 05[ ] 21-25 (15-16)
06[ ] 26-30 07[ ] 31-35 08[ ] 36-40 09[ ] 41-50 10[ ] 51-60 11[ ] 61+ hours per week

12. How many upper division courses have you completed in your major program while at Berkeley?
[Please include courses in other departments only if they are required for your program or specialization.] Number of upper division courses completed in your major program: _____ (17-18)

13. Thus far, what is your Grade Point Average for all courses completed at Berkeley? _____ (19-20)

14. About how many Berkeley faculty members: A. KNOW YOU by sight? _____ (21)
B. KNOW YOU by name? _____ (22)
C. KNOW YOU to some extent as an individual person? _____ (23)

15. About how many times did you have a discussion outside of the classroom with any professor, apart from study-list advising, in the last three months of instruction (i.e., excluding vacation periods)?
0[ ] None 1[ ] One or two 2[ ] Three or four 3[ ] Five or six 4[ ] Seven or more (24)

*The Program/Individual Identification Number is used only to check off who has responded when questionnaires are returned (so that we don't include you in a second mailing or use two responses from any one person). After responses stop coming in, we will destroy the number code on our name list, thus rendering individual responses absolutely untraceable. See cover letter and its appendix for additional details.

FACULTY, TEACHING, ADVISING

REMINDER: The word "program" in the questions below refers to the department, major plan, or double major that you indicated in Question 1 on the previous page.

GENERALLY SPEAKING, . . .	Strongly Disagree	Disagree	In Between	Agree	Strongly Agree	Don't Know or Not Applicable	
16. The faculty and program provide enough information about career opportunities for students with a Bachelor's degree in this major.	1	2	3	4	5	0	(25)
17. The faculty and program provide enough information about graduate and professional school programs to which I might want to apply.	1	2	3	4	5	0	(26)
18. The program's system of information and advising (faculty, secretaries, catalogs, etc.) makes it easy for me to choose courses, professors, and to understand how best to meet my academic needs.	1	2	3	4	5	0	(27)
19. The program provides a good general orientation for students new to the major.	1	2	3	4	5	0	(28)
20. I have a regular faculty advisor (or otherwise know a faculty member in my program) to whom I would feel comfortable going at any time during the year.	1	2	3	4	5	0	(29)
21. Communication between faculty and students in this program is open and fairly extensive.	1	2	3	4	5	0	(30)
22. I have been satisfied with the level of interaction I have had with professors here.	1	2	3	4	5	0	(31)
23. Faculty members in this program don't really seem interested in or concerned about undergraduates.	1	2	3	4	5	0	(32)
24. At least one professor in this program knows me or my work well enough to write me a good recommendation for graduate school or a job.	1	2	3	4	5	0	(33)
25. Comments or review provided by faculty, T.A.s and readers on my midterms, papers, problem sets, experiments and class performance are usually thorough enough.	1	2	3	4	5	0	(34)
26. Grading in this program is more rigorous than in most--it is very hard to get an "A."	1	2	3	4	5	0	(35)
27. Tests given by faculty in most of my courses in this program have measured fairly accurately my knowledge of the material.	1	2	3	4	5	0	(36)
28. Faculty in my program clearly state at the outset what the courses will cover and what students need to know or do to get an "A."	1	2	3	4	5	0	(37)
29. Compared to work in other programs, the students in this program must do a lot of work for the number of units (credit) awarded.	1	2	3	4	5	0	(38)
30. Most of the faculty in this program are receptive to student input on class structure and content.	1	2	3	4	5	0	(39)
31. I study and learn best in an environment with competition at a level such as we have here at Berkeley.	1	2	3	4	5	0	(40)
32. I have needed further explanation or extra instruction in courses in my major, but help or a referral did not seem easy to obtain.	1	2	3	4	5	0	(41)
33. Faculty in this program show enough concern about social issues in teaching their subjects.	1	2	3	4	5	0	(42)
34. In my opinion, there are enough women faculty in this program.	1	2	3	4	5	0	(43)
35. In my opinion, there are enough ethnic minority faculty in this program.	1	2	3	4	5	0	(44)
36. Teaching by faculty in this program is challenging, of high quality, and increases my interest in the subject matter.	1	2	3	4	5	0	(45)

37. Approximately what percentage of T.A.s (upper or lower division) in your program:

A. Are knowledgeable and well-prepared in the material being taught? 1[ ] 0-20% 2[ ] 21-40% (46)
3[ ] 41-60% 4[ ] 61-80% 5[ ] 81-100% 0[ ] Don't know or not applicable

B. Are effective as teachers in leading class discussions and/or labs? 1[ ] 0-20% 2[ ] 21-40% (47)
3[ ] 41-60% 4[ ] 61-80% 5[ ] 81-100% 0[ ] Don't know or not applicable

38. Using the rating scale which follows, please complete the two sentences below by filling in the number of the response that best describes your views:

1= Much more 2= More 3= Neither more nor less 4= Less 5= Much less 0= Don't know

A. Generally speaking, faculty in this program seem to be _____ supportive of and receptive to male than female students. (48)

B. Generally speaking, faculty in this program seem to be _____ supportive of and receptive to white than ethnic minority students. (49)

PLEASE CONTINUE ON TO THE NEXT PAGE

3

CURRICULUM

GENERALLY SPEAKING, . . .	Strongly Disagree	Disagree	In Between	Agree	Strongly Agree	Don't Know or Not Applicable	
39. Some of the lower division prerequisites are not really necessary for the upper division program.	1	2	3	4	5	0	(30)
40. There are enough course plan options within the department/program to meet my specialized interests in the subject matter.	1	2	3	4	5	0	(31)
41. Advanced courses are offered in the major (or are otherwise available) in all of my areas of interest.	1	2	3	4	5	0	(32)
42. There are too many required courses for the major.	1	2	3	4	5	0	(33)
43. The courses in this program do not relate well to each other; it is hard to get a good perspective on the field.	1	2	3	4	5	0	(34)
44. The coursework in this program is interesting and challenging.	1	2	3	4	5	0	(35)
45. Scheduling of courses is poor in this program: Required courses or subjects of interest to me are offered at the same time, crowded into one or two quarters, or are not being offered this year.	1	2	3	4	5	0	(36)
46. Large lecture classes can generally provide adequate learning opportunities in this field.	1	2	3	4	5	0	(37)
47. The curriculum is structured so that all majors will have a sufficient number of small classes or seminars.	1	2	3	4	5	0	(38)
48. There are enough fieldwork, internship, group, lab, or other academic-experiential course offerings in this program, and/or credit is readily available for appropriate types of volunteer experience.	1	2	3	4	5	0	(39)
49. There is a shortage of adequate equipment, computer facilities, supplies, or media materials for use by students in this program.	1	2	3	4	5	0	(60)
50. The program's methodology, lab, or technical courses do not provide the student with enough experience in real problem-solving and analysis.	1	2	3	4	5	0	(61)
51. The program's methodology, lab, or technical courses overemphasize traditional methodology and values or are not up-to-date.	1	2	3	4	5	0	(62)
52. There are enough courses available in this program which explore the contributions of the nondominant "schools of thought" (e.g., environmentalist, low-technology, radical, conservative, futurist, traditionalist, etc.).	1	2	3	4	5	0	(63)
53. I will remember a lot of what I have learned in the program's courses for a long time to come.	1	2	3	4	5	0	(64)

STUDENTS — VIEWS, PARTICIPATION, INFLUENCES, SATISFACTION

54. I have never been notified of a meeting of a general undergraduate organization (or professional society, where equivalent) in this program.	1	2	3	4	5	0	(65)
55. The program should (even if it does already) include undergraduates on most committees, provide an office, allow a quarterly mailing, etc., to facilitate undergraduate organizing and input.	1	2	3	4	5	0	(66)
56. I trust the faculty to take student needs and views into account in their decision-making for the program.	1	2	3	4	5	0	(67)
57. At least one form for student evaluation of teaching was distributed last quarter in each of the program's courses in which I was enrolled.	1	2	3	4	5	0	(68)
58. All faculty should occasionally use the ASUC Primer questionnaire to evaluate their larger courses and those required for the major, so that students will have access to evaluations of faculty teaching.	1	2	3	4	5	0	(69)
59. The program's office staff are generally quite helpful.	1	2	3	4	5	0	(70)
60. I have been impressed by the caliber or motivation of the other students in this major.	1	2	3	4	5	0	(71)
61. My skills in written communication will be adequate by the time I graduate.	1	2	3	4	5	0	(72)
62. My skills in oral communication will be adequate by the time I graduate.	1	2	3	4	5	0	(73)
63. My skills in quantitative analysis will be adequate by the time I graduate.	1	2	3	4	5	0	(74)
64. In my opinion, the proportion of women students in this program is too low.	1	2	3	4	5	0	(75)
65. In my opinion, the proportion of Black, Chicano and Native American students in this program is too low.	1	2	3	4	5	0	(76)

PLEASE CONTINUE ON TO THE REVERSE SIDE

STUDENTS — VIEWS, PARTICIPATION, INFLUENCES, SATISFACTION (continued)

66. To what extent are the following goals important to you, and to what to what extent has your major program met them?

		Very Low	Low	In Between	High	Very High	Don't Know or Not Applicable	
A. Preparation for a career:	Importance to you:	1	2	3	4	5	0	(77)
	Program's contribution:	1	2	3	4	5	0	(78)
B. Preparation for graduate or professional school:	Importance to you:	1	2	3	4	5	0	(79)
	Program's contribution:	1	2	3	4	5	0	(6) (80=1/1-5)
C. Providing a broad, general, humanistic or person-centered education:	Importance to you:	1	2	3	4	5	0	(7)
	Program's contribution:	1	2	3	4	5	0	(8)
D. Providing training in critical thinking and analysis:	Importance to you:	1	2	3	4	5	0	(9)
	Program's contribution:	1	2	3	4	5	0	(10)
E. Promoting social responsibility or developing skills useful in the community:	Importance to you:	1	2	3	4	5	0	(11)
	Program's contribution:	1	2	3	4	5	0	(12)
F. Gaining a thorough understanding of the subject matter:	Importance to you:	1	2	3	4	5	0	(13)
	Program's contribution:	1	2	3	4	5	0	(14)

67. Please rate the factors below as to their influence on your overall growth and learning while you have been attending college at Berkeley. Using the scale which follows, please put your ratings in the space provided:

1= Of very little influence 2= Somewhat influential 3= Moderately influential 4= Highly influential

A. [_____] The instructional process: classroom lectures, labs, class assignments (readings, homework, etc.), studying for exams, contact of all kinds with faculty, etc. (15)

B. [_____] Your own intellectual interests/pursuits (apart from any class assignments); your own choice of readings; etc. (16)

C. [_____] The broader University and community environment: campus and community activities of all kinds, artistic and cultural offerings, public lectures, rallies, local and ASUC politics, etc. (17)

D. [_____] Developments and issues in the international, national or state arenas: the ongoing social, political, economic and human situation. (18)

E. [_____] Interaction with peers (other students, roommates, friends, lovers, etc.) (19)

F. [_____] Your own special efforts at self-discovery or self-development (apart from those normally likely to occur through interaction with peers). (20)

G. [_____] Other personal commitments and involvements; for example, employment, family matters, a long-term leadership role or struggle with adversity, etc. (21)

68. All in all, how satisfied have you been to date with your total experience while at Berkeley?

1[ ] Very dissatisfied 2[ ] Dissatisfied 3[ ] Somewhat dissatisfied 4[ ] Neutral or mixed feelings (22)

5[ ] Somewhat satisfied 6[ ] Satisfied 7[ ] Very satisfied

0[ ] Don't know

69. All in all, how satisfied have you been to date with your major program (faculty, teaching, advising, courses/curriculum, testing-grading, governance, etc.)?

1[ ] Very dissatisfied 2[ ] Dissatisfied 3[ ] Somewhat dissatisfied (23)

4[ ] Neutral or mixed feelings 5[ ] Somewhat satisfied

6[ ] Satisfied 7[ ] Very satisfied 0 [ ] Don't know

70. Please rate the importance to you of each of the following possible reasons for your choice of career (however tentative) or major:

	Not at All Important	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Don't Know or Not Applicable	
A. Like the technical side of the work	1	2	3	4	5		0	(24)
B. Like the human side of the work	1	2	3	4	5		0	(25)
C. Want to make a social contribution (as a change agent, serving underserved communities, etc.)	1	2	3	4	5		0	(26)
D. Assurance that my income will always be good enough; or job security (e.g., unemployment won't be a problem, can relocate easily, etc.)	1	2	3	4	5		0	(27)
E. Opportunity to be creative or use my special talents	1	2	3	4	5		0	(28)

(29-79=6,80=2)

THANK YOU VERY MUCH FOR YOUR HELP IN RESPONDING TO THIS SURVEY EVALUATION!!

PLEASE FEEL FREE TO ENCLOSE ADDITIONAL COMMENTS ON A SEPARATE PAGE.

ENGINEERING SUPPLEMENT

1. Toward what career/profession are you currently leaning (as a first choice)? [Please be as specific as possible, indicating the nature of the work and the organization, for example: computer hardware development for corporation A; fusion research for D.O.E.; self-employed consultant for architecture firms; improving oil recovery percentages for company B; sanitary engineer for East Bay M.U.D.; sales/management for semi-conductor business; engineering/management for Calif. State Dept. of X; etc.] (1-5)

_____ (6-8)

_____

2. How definite is your choice of career? 1[ ] Very tentative
   2[ ] Tentative 3[ ] Fairly certain 4[ ] Definite
   0[ ] No career in mind/absolutely don't know (9)

GENERALLY SPEAKING, . . .	Strongly Disagree	Disagree	In Between	Agree	Strongly Agree	Don't Know or Not Applicable	
3. I have a fairly good knowledge of the specific kinds of tasks I will be doing when I begin my full-time professional work.	1	2	3	4	5	0	(10)
4. There is enough faculty participation in the student professional societies in my field of engineering.	1	2	3	4	5	0	(11)
5. I have had adequate guidance/information to select courses to fulfill my humanities and social sciences requirements.	1	2	3	4	5	0	(12)
6. I tend(ed) to choose my humanities and social science courses more with a view toward gaining some important general or supporting knowledge/understanding than for convenience of course scheduling, moderate workload requirements, etc.	1	2	3	4	5	0	(13)
7. I tend(ed) to choose my technical electives (Eng./Phy. Sci./Math/Stat.) more with a view toward gaining important supporting or general knowledge/understanding than for convenience of course scheduling, moderate workloads, etc.	1	2	3	4	5	0	(14)
8. College of Engineering Students: The humanities/social sciences depth requirement for three courses, at least one in upper division, to be completed in the same department, is more effective educationally than permitting more freedom of choice.	1	2	3	4	5	0	(15)
9. For my needs, the laboratory portions of UCB Department of Chemistry courses provided an effective learning experience.	1	2	3	4	5	0	(16)
10. For my needs, the Chemistry Department at UCB provided effective instruction and content in courses 1A-B/4A-B.	1	2	3	4	5	0	(17)
11. For my needs, the Physics Department at UCB provided effective instruction and content in the courses required for my program.	1	2	3	4	5	0	(18)
12. For my needs, the Mathematics Department at UCB provided effective instruction and content in the courses required for my program.	1	2	3	4	5	0	(19)
13. For my needs, the Engineering departments at UCB provided effective instruction and content in the lower division courses required for my program.	1	2	3	4	5	0	(20)
14. My skills in/on computers will be adequate by the time I graduate.	1	2	3	4	5	0	(21)
15. I have had one or more Teaching Assistants (T.A.s) whose skill in the English Language was simply not yet adequate.	1	2	3	4	5	0	(22)
16. I feel there is too much theory emphasized in most of my program's courses.	1	2	3	4	5	0	(23)
17. I would like the faculty to put more emphasis on the social responsibilities and ethics related to the profession and its practice (e.g., including the impact of technology and practice on environment, social structure, individuals).	1	2	3	4	5	0	(24)
18. Given the amount of homework typically assigned in my program's courses, the proportion of the grade awarded for the homework is usually too low.	1	2	3	4	5	0	(25)
19. In most of my program's courses, I could learn the subject matter just as well without as much homework.	1	2	3	4	5	0	(26)
20. Rather than grading on a curve, professors should use pre-established "absolute standards" that test for mastery of the fundamentals rather than details in my program's courses.	1	2	3	4	5	0	(27)
21. Too many midterms in my program require more time for me to complete than is allowed, so that my grades are unjustly influenced by the speed at which I work.	1	2	3	4	5	0	(28)
22. The program's faculty take adequate measures to prevent cheating.	1	2	3	4	5	0	(29)
23. Committee memberships, and agendas and background materials under consideration by committees in my department/program should be posted outside the program office in advance of committee meetings.	1	2	3	4	5	0	(30)
24. I would be interested in joining the engineering alumni assn. when I graduate.	1	2	3	4	5	0	(31)
25. I feel I know enough now to enable me to make effective choices about when and whether to attend graduate school [not which school to attend].	1	2	3	4	5	0	(32)
26. I plan to attend graduate school immediately after completing undergraduate work.	1	2	3	4	5	0	(33)

PLEASE CONTINUE ON TO THE REVERSE SIDE

27. Since your first year in college (i.e., not just at Berkeley), how much time have you spent in paid employment in the engineering field? (Please count all periods of work at 15 or more hours per week.)

0[ ] None 1[ ] Up to 3 months 2[ ] 3-6 months 3[ ] 6-9 months 4[ ] 9-12 months (34)
5[ ] 12-15 months 6[ ] 15-18 months 7[ ] 18-27 months 8[ ] 27-36 months 9[ ] 36+ months

28. What is/has been your relationship to the Cooperative Work-Study Program (CWSP)?

1[ ] Have available independently what CWSP provides 2[ ] Have worked/am working in CWSP (35)
3[ ] Unable to locate a satisfactory employer 4[ ] Don't know how to apply for a CWSP position
5[ ] Cannot/will not extend beyond 4-year college program 6[ ] Do not feel qualified enough to apply
7[ ] Not interested or not applicable
8[ ] Other: please specify:

		Str. Dis.	Dis.	In Bet.	Agr.	Str. Agr.	D.K./ N.A.	
29.	From what I know about the Career Planning and Placement Center so far, the services seem adequate to meet my needs for planning/search/placement.	1	2	3	4	5	0	(36)
30.	I am interested in more opportunities for contact with ECE alumni or others working in the profession, and/or with companies or agencies in the field.	1	2	3	4	5	0	(37)
31.	A. I am aware of the registration requirements, if any, to become a (licensed) professional engineer in my field.	1	2	3	4	5	0	(38)
	B. I have worked/am working part-time with a registered engineer while in school, or have ready access to such work were I to ask.	1	2	3	4	5	0	(39)
	C. I intend to complete the Engineer-in-Training examination before finishing my undergraduate work.	1	2	3	4	5	0	(40)

32. Assuming the unit values for 5 to 10 of the courses in your entire lower and upper division program were determined to be too low (e.g., by one unit each) and that plans were being made to raise them, please rate the desirability of using each of the following means of programmatic adjustment.

● In all cases below, assume the continuation of the current policy allowing students to take up to 15 units more than the minimum required to graduate.
(In cases F, G and K, some of the 5-10 upward unit adjustments might be cancelled out--to the extent they were chosen for reduction in workload.)

		Do Not Want At All	Want a Little	Want Somewhat	Want Very Much	Want As Much As Possible	Don't Know or Not Applicable	
A.	Require more than 130 units to obtain the B.S. degree. (Program completion time may extend beyond four years for more students.)	1	2	3	4	5	0	(41)
B.	Lower the number of free elective course units in the program.	1	2	3	4	5	0	(42)
C.	Lower the number of required course units in the humanities and social sciences.	1	2	3	4	5	0	(43)
D.	Lower the number of units in technical electives (i.e., electives in your own or other engineering departments, physical sciences, math, statistics).	1	2	3	4	5	0	(44)
E.	Lower the number of courses (or total units) required within the upper division program in my major.	1	2	3	4	5	0	(45)
F.	Reduce the extent of laboratory work in required courses (lower or upper division), adjusting unit values as appropriate.	1	2	3	4	5	0	(46)
G.	Reduce the homework in required courses where it is unnecessarily detailed (lower or upper division), adjusting unit values as appropriate.	1	2	3	4	5	0	(47)
H.	Reduce the breadth and/or depth of coverage in areas of coursework currently required but of lower priority to the program, adjusting unit values as appropriate. (H. is intra-course, I. is inter-course.)	1	2	3	4	5	0	(48)
I.	Leave things as they are (i.e., even with units too low in some courses).	1	2	3	4	5	0	(49)

33. Please indicate the extent to which you participate in the student professional engineering society in your field/department (e.g., A.S.C.E., T.C.S.I.E., etc.).

1[ ] Member, active 2[ ] Member, occasionally attend/participate 3[ ] Member, not active (want to be more than one meeting) (50)
4[ ] Not a member 5[ ] Other: please specify:

DO YOU HAVE ANY IDEAS ON HOW TO MAKE THE ACTIVITIES OF YOUR STUDENT PROFESSIONAL SOCIETY MORE WORTHWHILE?

34. To what extent do you participate in other societies relevant to engineering?

A. National Society of Professional Engineers: 1[ ] Active (51)
2[ ] Occasionally attend/participate 3[ ] Not active (want to be more than one meeting)

B. Society of Women Engineers: 1[ ] Active (52)
2[ ] Occasionally attend/participate 3[ ] Not active (want to be more than one meeting)

C. Tau Beta Pi (general engineering honor society): 0[ ] Not applicable 1[ ] Active (53)
2[ ] Occasionally attend/participate 3[ ] Not active (want to be more than one meeting)

D. Honor society in your department/program: 0[ ] Not applicable 1[ ] Active (54)
2[ ] Occasionally attend/participate 3[ ] Not active (want to be more than one meeting)

PLEASE FEEL FREE TO ENCLOSE ADDITIONAL COMMENTS IN A SEPARATE PAGE.

THANK YOU VERY MUCH FOR YOUR HELP WITH THIS PART OF THE EVALUATION!,

IF THERE IS ALSO A SUPPLEMENT FOR YOUR DEPARTMENT/PROGRAM, PLEASE CARRY ON A LITTLE FURTHER.

APPENDIX D

ACADEMIC REVIEW UNIT REPORTS[1]

(including those receiving substantial consultative support)

1. Jeff Koon (compiler), Engineering and Physical Science Programs at Berkeley. (Berkeley: ASUC Academic Affairs Office, 204 Eshleman Hall, University of California, 94720; 415-642-0256; January 1981.)
2. Jeff Koon (compiler), Social Science-Related Programs at Berkeley. (November 1979.)*
3. Carlos Rios (compiler), The Chicano Studies Program at Berkeley: An Evaluation by Its Alumni. (September, 1979.) [Funded by ASUC Academic Affairs Office Mini-Grant Program.]*
4. Paul M. Nichols, Christine Onorato, Donne Pensky (undergraduate committee) and Christian Marouby, Eilene March (graduate committee), Department of French: Reports by Students of French to the Letters & Science Ad Hoc Committee to Review the Department. (April 1979.)*
5. Jeff Koon and Austin Allen, "Undergraduate and Graduate Enrollments of Blacks and Chicanos in Fall 1978, and Change Since Fall 1974 [at U.C. Berkeley]." (April 1979.) [Workload not recognized by funding authority.]*
6. Jeff Koon (with Austin Allen), "Acceptance/Persistence Rates of Women Students in Graduate Study, by Level, and FTE-Utilization of Qualified Women on the L & S Faculty, by Department [at U.C. Berkeley]." (December 1978.) [Workload not recognized by funding authority.]*
7. Jeff Koon (compiler), Lower Division Education at Berkeley: The Students' Assessment. (October 1978.)*
8. Andrew Hanami (compiler), Evaluation of the Undergraduate Programs in the Department of Instruction in Biology and the Zoology Department. (August, 1978)*
9. Jeff Koon, the faculty workload and student/faculty ethnic minority and women faculty tables in Mark Courtney, "Academic Affairs Office Statement on Faculty Teaching Workload, Student Participation, Educational Policy and Social Responsibility." (April 1978.)* [Workload not recognized by funding authority.]
10. Carol Brewer and Jeff Koon (compilers), Evaluation of Undergraduate Study in the Pre-Health Sciences at the University of California, Berkeley, 1977. (May 1978.)*
11. Jeff Koon, "Undergraduate Education at the University: A Low Priority." (November 1977.)* [Workload not recognized by funding authority.]
12. Jeff Koon (compiler), Life Science-Related Departments and Programs at Berkeley. (September 1977.)*
13. Jeff Koon (compiler), Selected Humanities Departments at Berkeley. (August 1977.)*
14. Andrew Hanami (compiler), The Undergraduate and Graduate Major Program [in] History of Art. (August 1977.)*
15. Jeff Koon (compiler), The Undergraduate Major Program in Spanish. (July 1977.)*

*The publisher is in all cases the same as in the first entry.

[1]Reports on Subject A (Anne Hafner & Jeff Koon), now in draft form, and on Women's Studies, now in preliminary form, will also become available if ASUC Academic Affairs Vice President Nancy Skinner cares to ensure their completion.

Appendix D
(continued)

16. Stanley Mar, "The Undergraduate Programs in Art (& Art History and Music)." (Spring 1977.)*

17. Erica Baum et al., An Academic Review of the School of Social Welfare's Undergraduate Group Major. (Spring 1976.)*

18. Jill Breslau et al., An Academic Review of the Undergraduate Program of the Department of Political Science. (Spring 1976.)*

19. Paul Dreyfus et al., An Academic Review of the Undergraduate Program of the Mathematics Department. (Spring 1976.)*

20. Bob Pena et al., Report of the ASUC Academic Affairs Committee to Review the School of Journalism. (August 1975.)*

21. Warren Kinsler, Bob Pena, et al., Report of the ASUC Academic Affairs Committee to Review the New Program in Law, Society, and Criminal Justice. (July 1975.)*

22. Richard Harrison, Jeff Koon, Bob Pena, Jeff Dornbusch, Martha Cohen, Debbie Fahey, and Winston Chao, Report of the ASUC Academic Affairs Criminology Review Committee. (October 1974.)* [Report precedes the initiation of the ASUC Academic Review Unit.]

*The publisher is in all cases the same as in the first entry.

APPENDIX E*

June 1, 1980

Dear Members of the Representative Assembly,

This letter concerns the report on student FTEness which is presented today by the Committee on Senate Policy. Attached here are the preliminary (and newly-available) results on an FTEness-related item from a survey of randomly selected samples of undergraduate majors enrolled in six departments in the College of Engineering and the Department of Chemical Engineering. The survey was sponsored by the Engineers Joint Council (EJC) and supported by the ASUC's Academic Review Unit. The response rate for all students who actually received a questionnaire was 57%. This inquiry is particularly timely because, as you may know, the recent shifts of undergraduate student enrollments to more science/engineering coursework has made the FTEness problem worse.

Basically, we inquired about what engineering majors would prefer to have done if the unit values in 5 to 10 of their courses, whether in upper or lower division, were determined to be too low (e.g., by one unit each). Although the responses suggest that there is no truly happy solution and, to some extent, that the several departments may wish to undertake different kinds of actions with regard to their programs, the most widely accepted solution by the students was to require more than 180 units for the B.S. degree. A requirement of more than 180 units for some B.S. degrees should not affect the actual workloads of students in engineering, since they already de facto work more than 180 units worth for their degrees and sometimes need to enroll for fewer units as a result.

In other ratings not shown here, the students in four of the engineering departments also identified some of the upper division courses that may well be under-valued in terms of units. However, similar or greater under-valuation in lower division (esp.) courses in Chemistry, Physics and perhaps other departments undoubtedly makes a yet more substantial contribution to the decline in the average FTEness of undergraduate students, because of their large enrollments of science and engineering students.

As a result of these considerations, we urge that recommendation number one of the FTEness committee be taken very seriously, that unit values be awarded based on the actual, total course workload, and that recommendation number two (minimum progress rules) not be adopted or enforced until a full review of under-valued courses has been completed. If minimum progress rules are enforced prior to adjustment of under-valued courses, all of the burden is placed unfairly on students, and especially on those with moderate levels of responsibility outside the University, with resulting negative effects on the retention of students, their satisfaction, morale and education.

Thank you for listening.

Sincerely,

William Johnson, President

Paul Kleinen, Secretary

Engineers Joint Council

This letter is based on a discussion of the results of the questionnaire item at the regular meeting of the EJC on May 27, 1980.

*This letter was distributed to members of the Representative Assembly as they came to the meeting on June 3, 1980. The attachment referred to in the letter presented the data now shown on pages 53-54 of this report.

APPENDIX F

May 1980

Dear Engineering or Physical Science Student,

THANK YOU!

Thank you very much for your recent response to the student survey evaluation of your academic major program. Your contribution has helped to make the evaluation a success.

The response rate for the survey, which will climb a bit higher yet, is now at 53% (57% if one discounts students who moved and never received their questionnaire). In the past, the Academic Review Unit (ARU) has found that this level of response is adequate to ensure that the results are fairly representative of the entire sample, but we will conduct a series of tests on the engineering/physical sciences data to show faculty and administrators and students the extent of that representativeness.

PROBLEM: Statement & Discussion

Unfortunately, the representativeness of the respondents is not the only question that is raised about student evaluations of academic programs. Questions may also arise as to the statistical "reliability" of the results. That is, some critics of student evaluations may argue that student responses to the program evaluation survey items are too haphazard or random to be very meaningful. Put another way, the question is whether student responses are stable and consistent over time. (If student views fluctuate sharply over short periods of time, before any change has occurred in a program, it may be rather difficult to draw conclusions from the results of a student evaluation.)

These questions about the statistical reliability of the ratings of respondents will not be put to rest until a sample of responses from a group of students is compared statistically with a subsequent set of responses from the same individuals.

STUDY NEEDED

Because of these questions, the Academic Review Unit is asking for your help a second time. To complete the efforts being made to gain full respect for the results of student ratings of their academic programs, the ARU must conduct a reliability study. To do so, we have drawn a random sample consisting of one out of six of the original respondents, and we will be asking them to respond a second time to the "Undergraduate Major Program Evaluation Questionnaire" (UMPEQ).

REQUEST YOUR HELP; VALUE OF STUDY

Your name has been drawn randomly for inclusion in this second sample. You have been very helpful and generous with your time previously, and we hope that you will be able to give just a little more time to this very important cause. While the ARU expects to establish in general the extent of the statistical reliability of student responses to program evaluation surveys, your response will make a special contribution to strengthening the Engineering and Physical Sciences evaluation, where this reliability study is 100% applicable.

Your help here will also be especially important to the future of education at the University (and other colleges and universities). With the decline in the population of typical college age youth during the next 15 years, almost all higher education institutions will need to know about

PLEASE READ THIS LETTER IN FULL (over please)

the extent to which they can rely on student evaluations to provide feedback on how to improve their programs -- to educate students more effectively, to retain student interest, motivation and enrollments, and to make a university/college education more attractive to prospective students. To the best of my knowledge, this is the first study of its type anywhere, and this makes your contribution all the more significant.

RESPONSES

Your responses to the attached survey will again be entirely confidential (as described in the original survey cover letter and its appendix). A postage prepaid return envelope has again been included.

QUESTIONS?

If you have any questions about this study of reliability, or about the student evaluations of the Engineering and Physical Sciences programs at UCB (which are now being keypunched), please feel free to call me at the ASUC Academic Affairs Office: 642-0256. Please leave a callback message if need be (I only work half-time), giving your name, phone and best times to call.

AGAIN, THANK YOU VERY MUCH!

Sincerely,

Jeff Koon

Jeff Koon
Academic Review Unit Coordinator
ASUC Academic Affairs Office
208 Eshleman Hall
U.C. Berkeley 94720
642-0256

INSTRUCTIONS FOR SURVEY RESPONDENTS

The above letter describes the reasons you are being sent this questionnaire for a second time, and its importance. Basically, there is a need to demonstrate statistically the extent to which student ratings of their academic programs can be relied upon for consistency and stability, by comparing the responses of the same students at two different times of questionnaire administration. This comparison is a purely statistical procedure which in no way reflects on individual respondents--who will in any case be totally protected by confidentiality.

When you fill out the questionnaire, simply proceed through the evaluation just as you did the first time, and just as if you were responding for the first time. Please DO NOT change your ratings to fit what you think your response was the first time. (If there is some change in student views over a 3-month period, as we would all expect, your "natural" answers this time will provide us with a best estimate of the extent of this change.)

Again, thank you very much for your extra special effort on behalf of this study to establish the extent to which student evaluations of their academic programs are reliable and consistent over time, and to strengthen the Engineering/Physical Sciences review.